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THE AMERICAN PHILOSOPHICAL SOCIETY

THE annual meetings of the American Philosophical Society, which this year were held April 18 to 20, have now become a permanent feature and are looked forward to by the members as an agreeable occasion for meeting colleagues from various parts of the United States and for listening to papers covering the entire range of scientific investigation. In the latter respect the sessions are unique, and it is perhaps well in these days of extreme specialization that there should be one organization which should not merely cover all the so-called natural sciences but extend its range to history, archeology and philology, as well as literature.

In all five sessions were held for the reading of papers, which left plenty of time for the full presentation of the thirty-five papers that had been announced. The session of Friday morning was rendered particularly interesting by the presence of the Honorable James Bryce, the British Ambassador, who was formally presented to the members and made a happy address. After the luncheon on Friday, Mr. Bryce presented the gold medal of the Royal Astronomical Society to Professor Ernest W. Brown, in recognition of his important contributions to the problems relative to the motions of the moon.

The sessions were, as far as possible, so arranged as to place papers of the same class together. In accordance with this plan, the papers for Thursday afternoon and part of Friday morning were chiefly

philological and historical, those for the rest of Friday botanical, chemical and engineering. Saturday morning was devoted largely to geology, and Saturday afternoon to astronomy, while the papers covering other branches were sandwiched in, as it was found convenient, amid the general broad subjects. It is not possible within the scope of a general account to do more than say a few words about a limited number of the papers read.

Among the papers read at the first session, on Thursday afternoon, was one by Professor W. A. Lamberton on the Greek phrase of the New Testament ordinarily translated 'walking on the sea,' but which Professor Lamberton held, on the basis of an elaborate investigation of the text, should be rendered 'walking at the sea.' The speaker claimed that in the narrative of John, Jesus is not represented as either entering the ship or walking on the sea, but rather on the shore close to the water-edge.

Mr. Rosengarten's paper on the early French members of the American Philosophical Society included an account of the many Frenchmen who at the end of the eighteenth century and in the beginning of the nineteenth century came to this country and became associated in the work of the society. Buffon was the first Frenchman to be elected a member of the society, in 1768.

Professor A. Marshall Elliott, of the Johns Hopkins University, presented a paper of great interest on the origin of the word chauvinism, in which, among other things, he pointed out that the attempt to trace this word to a real character rested upon the slenderest foundations.

Professor Jastrow's paper on the liver as the seat of the soul was an investigation of various views held by the ancients regarding the organ associated with the soul. The paper showed that while the generally prevailing view of antiquity placed the soul in the heart and subsequently in the brain, there were traces of an earlier belief which assigned to the liver the distinction of being the seat of the soul.

Professor Paul Haupt, of the Johns Hopkins University, read a paper on Jonah's whale which was devoted to showing the kind of animal that the narrator of the Book of Job had in mind. The important feature of Professor Haupt's paper was the determination of the fact that whales were known to the ancient Assyrians and are referred to in inscriptions as early as the twelfth century before this era.

Professor Lewis M. Haupt, of Philadelphia, presented an important communication on the transportation crisis, in which, after a survey of the earlier methods of transportation in this country, he urged the importance of water highways as the remedy for the rapidly increasing difficulties of transportation by railroads.

Dr. Henry Kraemer gave an outline of a continuation of the interesting studies in producing and modifying the color in plants by treating them with certain chemicals.

Dr. Howard Crosby Butler gave an interesting account of the Princeton expedition to Syria in 1904–5 which did important work in surveying, in the study of architecture, and added considerably to our knowledge of the inscriptions and other archeological material in a comparatively little known portion of Syria.

The paper by Professor Titchener, of Cornell, in collaboration with W. H. Pyle, of Cornell, on the influence of imperceptible shadows on the judgment of distances demonstrated that the current view that optical illusions in estimating distances by the eye persist even when the lines that produce the illusion are so weak as to be imperceptible is not in accordance with the

facts. The conclusion was, therefore, drawn that the subconscious need not be taken into account in the psychological explanation of optical illusions.

Professor William F. Magie, of Princeton, in a paper on the association theory of solutions, expressed the view that the heat capacity of electrolytic solutions and the volumes of solutions can be satisfactorily represented by a formula constructed on the hypothesis that each undissociated molecule of the solution associates with itself a group of water molecules. The heat capacity of the solution is additive of the heat capacities of these groups and of the water lying outside of them.

Dr. T. J. See, of Mare Island, California, supplemented his former paper on the theory of earthquakes which is published in the *Proceedings* of the American Philosophical Society, for 1906, by the further examination of the temperature and secular cooling of the earth, in which he showed that the effects of contraction are nearly insensible. The necessity of therefore abandoning old theories becomes more patent. It is interesting to note that four great writers of antiquity—Plato, Aristotle, Strabo and Pliny—ascribe earthquakes to the agitation of elastic vapors in the earth, a confirmation of his own theory to which Dr. See attaches considerable importance.

Dr. Elihu Thompson, of Swampscott, Mass., in his paper on the progress of the Isthmian Canal, gave, on the whole, a favorable account of the condition of the work. The organization was pronounced to be admirable, and this, taken together with the successful work of sanitation under the charge of Colonel Gorgas, gives every reason to believe that the canal will be finished in from eight to ten years.

Among the geological papers, that of Professor William B. Scott, of Princeton, giving illustrations of the restoration of the Santa Cruz mammals, was the most striking. Two other members of the geological department of Princeton, Messrs. Sinclair and Farr, were represented by papers, all touching on the results of the Santa Cruz expedition of Princeton University.

Another paper of general interest, that by Bailey Willis on continental development, was devoted to a discussion of the various hypotheses to account for the circumstance that each of the two great continents is composed of distinct masses which have tended to stand high in relation to their surroundings.

Professor Eric Doolittle's paper was on two remarkable stars. One, discovered in 1882 by Hough, was for a time in danger of being rejected, until in 1899 it was independently rediscovered by See. The motion of this double star during the past two years has been so rapid that already a fairly good orbit can be computed. The second pair is made up of two very faint stars more than three and one half seconds apart, a remarkable circumstance, for of all the double pairs there are none at once as faint and wide as this pair, except those which are connected with very bright stars.

The session on Thursday evening was of a popular character, being held in Witherspoon Hall and devoted to South Africa. The subject was divided between Professor William B. Scott, of Princeton, and Professor E. W. Brown, of Haverford. The former spoke about the geology and geography of South Africa, and the latter about the scenery and people. Both lectures were illustrated by stereopticon views. On the conclusion of the lectures, a reception was held by the president and council.

At the close of the Saturday morning session, balloting for new members was

taken up, which resulted in the election of twelve persons resident in the United States —George Ferdinand Becker, Ph.D., Washington; Charles Benedict Davenport, Ph.D., Cold Spring Harbor, L. I.; J. P. Croser Griffith, M.D., Philadelphia; Frank Austin Gooch, Ph.D., New Haven; Herbert Spencer Jennings, Ph.D., Baltimore; James Playfair McMurrich, Ann Arbor, Mich.; Edward Laurens Mark, Ph.D., LL.D., Cambridge, Mass.; John Bassett Moore, LL.D., New York; Francis Eugene Nipher, St. Louis; Horace Clark Richards, Ph.D., Philadelphia; John C. Rolfe, Ph.D., Philadelphia; and Allen J. Smith, M.D., Philadelphia—and five foreigners—Baron d'Estournelles de Constant, Paris; George Carey Foster, F.R.S., D.Sc., LL.D., Rickmansworth, Herts, England; J. J. Jusserand, Washington; Sir William Turner, K.C.B., D.Sc., D.C.L., F.R.S.; and John C. Kapteyn, Gröningen, Holland.

On Saturday evening the sessions were closed with a banquet at the Bellevue-Stratford, attended by about a hundred members of the society. Professor Albert H. Smyth, of the Central High School, the sad news of whose sudden death has just been announced, acted as toastmaster and presented, among others, the following speakers: Judge Sulzberger, who responded to the toast, 'The Memory of Franklin'; Professor John W. Rhys, of Oxford, who spoke on 'Sister Societies'; and the Honorable Charlemagne Tower, who made an interesting address on 'The Aims and Purposes of the Society.'

All the scientific sessions were well attended, and the society has every reason to feel gratified at the interest shown by members in coming, many of them from a very great distance, to read or to listen to papers.

The following is a list of the papers read:

THURSDAY, APRIL 18

Retardation in Mental and Moral Development—A Problem of Public Education: Dr. Lightner Witmer, of Philadelphia.

Analogies between the Colonization of Ireland and of Virginia: Professor Edward P. Cheyney, of Philadelphia.

Elizabethan and Jacobian College Dramas: Professor Felix E. Schelling, of Philadelphia.

The Narratives of the 'Walking on the Sea': Professor William A. Lamberton, of Philadelphia.

Early French Members of the American Philosophical Society: Dr. J. G. Rosengarten, of Philadelphia.

The Influence of Imperceptible Shadows on the Judgment of Distance: Professor Edward B. Titchener and W. H. Pyle, of Ithaca.

Chauvin (Chauvinism-Calvin, Cauvin): *Truth and Fiction in the Story of its Origin:* Professor A. Marshall Elliott, of Baltimore.

FRIDAY, APRIL 19

Provisional Report of the Investigation of Foreign and Domestic Stage Micrometers: Dr. Marshall D. Ewell, of Chicago.

The Liver as the Seat of the Soul: Professor Morris Jastrow, Jr., of Philadelphia.

On Jonah's Whale: Professor Paul Haupt, of Baltimore.

Charts Illustrating the Taxonomic Relations of the Monocotyledonous and Dicotyledonous Plant Families: Professor John W. Harshberger, of Philadelphia.

Some Experiments with Plant Nutrients: Professor Henry Kraemer, of Philadelphia.

The Bacteriology of Flax Retting: GEORGE T. MOORE, Ph.D., of West Chester, Pa.

Note as to the Measurement of the Action of Water upon Zinc and Lead: DR. WILLIAM PITT MASON, of Troy, N. Y.

New Results in Electro-Analysis: Dr. EDGAR F. SMITH, of Philadelphia.

The Production of Synthetic Alcohol: Dr. HARVEY W. WILEY and HERMAN SCHREIBER, of Washington, D. C.

The Progress of the Isthmian Canal: Dr. ELIHU THOMSON, of Swampscott, Mass.

On the Transportation Crisis: Professor LEWIS M. HAUPT, of Philadelphia.

The Princeton Archeological Expedition to Syria: HOWARD CROSBY BUTLER, of Princeton. (Lantern illustrations.)

The Association Theory of Solutions: Professor WILLIAM F. MAGIE, of Princeton.

The Groups which are Generated by Two Operators of Order Two and Four respectively, where Commutator is of Order Two: Professor G. A. MILLER, of Urbana, Ill.

SATURDAY, APRIL 20

Santa Cruz Typotheria: W. J. SINCLAIR, of Princeton. (Lantern illustrations.)

Santa Cruz Birds: MARCUS S. FARR, of Princeton.

Restorations of Santa Cruz Mammals: Professor WILLIAM B. SCOTT, of Princeton.

On the Temperature, Secular Cooling and Contraction of the Earth, and on the Theory of Earthquakes held by the Ancients: Dr. T. J. J. SEE, of the U. S. Naval Observatory, Mare Island, California.

On Continental Development: BAILEY WILLIS, M.E., of Washington.

A Study of the Mean Temperatures of the Surface of the Moon, Earth and other Planets: Professor CLEVELAND ABBE, of Washington.

The Solar Corona: W. W. CAMPBELL, of Lick Observatory, California. (Illustrated.)

Astronomical Photography: Professor E. E. BARNARD, of Yerkes Observatory, Williams Bay, Wis.

Conservative Systems with Prescribed Trajections: Professor E. O. LOVETT, of Princeton.

Comparison of Results of Observations at the Flower Observatory for the Years 1905 and 1906, with the Wharton Reflex Zenith Tube and the Zenith Telescope: Professor C. L. DOOLITTLE, of Upper Darby, Pa.

Comparison of Results of Latitude Observations at the Sayre Observatory, South Bethlehem, and at the Flower Observatory, Philadelphia, from September 30, 1904, to September 3, 1906: J. H. OGBURN, of Bethlehem, Pa.

Two Remarkable Double Stars: (a) the short period Binary, Hough 212, and (b) the Stellar System Krueger 60: ERIC DOOLITTLE, of Upper Darby, Pa.

THE SOCIETY OF AMERICAN BACTERIOLOGISTS

THE eighth annual meeting of the Society of American Bacteriologists was held in New York during Convocation Week. The meetings were held at the College of Physicians and Surgeons, and at the Rockefeller Institute, the latter in conjunction with Section K of the American Association for the Advancement of Science.

The first session of the society was held on Thursday morning, December 27, in the main lecture room of the College of Phy-

sicians and Surgeons, and, after a short business meeting for the reading of reports and the nomination of new committees, a number of interesting papers were presented on various general aspects of bacteriology, morphology, physiology, etc. The joint meeting at the Rockefeller Institute on Friday morning was devoted largely to the discussion of subjects of interest alike to the bacteriologist and the pathologist and chemist. The papers at this session were largely devoted to various investigations of sera, toxins, and the biology of pathogenic bacteria and other organisms. The third session, on Saturday morning, at the College of Physicians and Surgeons, dealt with laboratory procedure, methods of cultivation of certain bacteria, and studies on the bacteriology of milk.

The following officers were elected for the present year:

President—Dr. James Carroll.

Vice-president—Professor F. D. Chester.

Secretary-Treasurer—Professor S. C. Prescott.

Council—Dr. J. J. Kinyoun, Dr. F. G. Novy, Dr. F. P. Gorham, Dr. H. W. Conn.

Delegate to the American Association for the Advancement of Science—Dr. Erwin F. Smith.

The papers, of which abstracts, or titles alone, are presented below, were as follows:

Movements of Certain Bacteria in Soils: Karl F. Kellerman and Edna H. Fawcett, Bureau of Plant Industry, Department of Agriculture, Washington, D. C.

Two organisms have been studied in connection with *Pseudomonas radicicola, Bacillus ochraceus* and a form resembling *Bacillus coli.* The latter kills *Pseudomonas radicicola* when in synthetic nitrogen-poor sugar bouillon, but not in soil extracts of favorable soils; *Bacillus ochraceus* has little effect upon *Pseudomonas radicicola* under either condition.

In sterilized favorable soils saturated with water *Bacillus ochraceus, Pseudomonas radicicola,* and the paracolon organism grow with almost equal speed, progressing about one inch in forty-eight hours. In soils barely moist *Pseudomonas radicicola* progresses at the rate of about one inch in seventy-two hours, while the two other forms are reduced to a rate of about one inch in eight days. These experiments were all conducted at a temperature of 25° C. At a temperature of 10° C. the rate of *Pseudomonas radicicola* was reduced to one inch in three days in saturated soil; the two other organisms had made practically no growth at the end of thirty days.

Under none of the conditions of these experiments did there seem to be any antagonism in the soil between *Pseudomonas radicicola* and *Bacillus ochraceus* or the paracolon organism.

Further Studies on Putrefaction: Leo F. Rettger, Yale University.

1. Real putrefaction is caused only by obligate anaerobes. None of the obligate aerobes and facultative anaerobes thus far studied have revealed this property. Some organisms like *B. pyocyaneus* and *Proteus vulgaris* are able to slowly digest coagulated egg albumin and blood serum, but the products are not those of putrefaction. Mercaptan in particular is invariably absent.

2. *B. putrificus* (Bienstock), the bacillus of malignant œdema and of symptomatic anthrax are putrefactive organisms, though they may vary at times in this respect. None of the strains of *B. tetanus* so far examined have shown any putrefactive action in the so-called egg-meat medium.

3. *Bacillus aerogenes capsulatus* of Welch (or *B. enteritidis sporogenes* of Klein) is essentially a fermentative organism. At no time has it been able to cause any apparent decomposition of coagulated proteids, although cultures of the organism often have a decided putrefactive odor.

4. Normal feces in a large percentage of cases caused a marked decomposition of the egg-meat medium. In a large number of such cases the *Bacillus putrificus* of Bienstock was observed to be responsible. In at least 25 per cent. of the stools examined the bacillus of malignant œdema was present, though in small numbers. The amount of feces tested at one time varied from 2 to 32 milligrams. The *Bacillus aerogenes capsulatus* of Welch was found to be present constantly when the quantity of feces examined was at least 32 milligrams. In 2 milligram quantities, however, it failed to reveal itself in at least 50 per cent. of the tests that were made with such small amounts.

A Study of the Variation in the Biochemical Reactions produced by Cultures of the Colon Type: STEPHEN DEM. GAGE.

The study was made to ascertain how closely the variations in the intensity of certain biochemical functions of cultures usually included in the colon group by routine tests would agree with the law of biological variation.

About 200 cultures of the colon type, as interpreted at the Lawrence Experiment Station, were examined after incubation at 40° C. for the amount of gas produced in dextrose broth in 24 and 48 hours, for the proportion of CO_2 in that gas, and for the amount of ammonia and of nitrites produced in nitrated pepton solution in 24 hours.

The amount of gas produced in 24 hours varied between 15 per cent. and 100 per cent., about four fifths of the cultures producing between 40 and 70 per cent. of gas.

After 48 hours' incubation the amount of gas also varied between 15 per cent. and 100 per cent., and the distribution of the cultures among the different gas values was more uniform than at the end of 24 hours, about half of the cultures producing between 35 per cent. and 50 per cent. of gas. With 15 per cent. of the cultures the amount of gas increased between the first and second day, while with 65 per cent. of the cultures there was a decrease in the amount of gas on the second day.

The amount of CO_2 in the gas at the end of 48 hours varied from none to 75 per cent., about three fourths of the tubes containing between 10 and 25 per cent. of CO_2.

In the nitrated pepton solution at the end of 24 hours about 30 per cent. of the tubes contained less than one part per million nitrogen as ammonia, and about half of the tubes contained between one and three parts, while about one fourth of the tubes contained less than one part nitrogen as nitrites, and about half of the tubes contained between one and three parts.

The number of determinations was altogether too small to plot curves of biological variation with any degree of accuracy. The curves plotted, however, appear to be simple, unimodal curves, and indicate that the group was a true biological group and that the variations were normal biological variations.

Involution and Degeneration Forms of Bacteria: D. H. BERGEY, M.D.

The indefinite and confusing definitions of the nature of involution and degeneration forms of bacteria found in most textbooks on bacteriology are bewildering to the student, and leave him in doubt as to the exact significance of these terms.

The term 'involution forms' is defined in the Standard Dictionary as 'certain swollen, bladder-like and irregular forms which the organisms sometimes assume after their death, or as the result of deleterious influences, such as insufficient nutrition.' This definition is sufficiently clear,

and is in general use by authorities in text-books on bacteriology.

The term 'degeneration forms' is, however, less definitely defined in the text-books. The Standard Dictionary defines degenerate, ' to become worse or inferior; decline in character, qualities, or excellence, as from the normal or primitive condition or from a type of standard; deteriorate.' According to this definition, the term 'degenerate forms' should be reserved for those organisms that had reached the normal stature and subsequently manifested the effects of degenerative influences. These effects are seen principally as vacuolation, granulation, and fragmentation of the protoplasm in organisms of normal size and shape.

The Production of Indol in Proteid-free Media: M. X. Sullivan, Brown University, Providence, R. I.

Several years ago, I found that *B. coli communis* would grow well on non-proteid media. At that time no tests were made to determine whether or not indol and skatol were produced on these media. Under the pressure of other work the experiments on *B. coli* were not continued. Recently, however, my attention was again directed to the metabolism of *B. coli* by L. F. Rettger's article ' Studies on Putrefaction,' *Jour. of Biol. Chem.*, '06, Vol. II., p. 71. Accordingly solutions of non-proteid media were made and inoculated with a pure culture of an indol-forming variety of *B. coli* in order to determine whether or not this bacillus could produce indol in simple media.

The culture medium on which the present conclusions are based consisted of

Asparagin	0.2	grm.
Mannite	0.2	
NaCl	0.02	
$MgSO_4$	0.01	
$CaCl_2$	0.02	
K_2HPO_4	0.2	
H_2O	100	c.c.

This medium was made slightly alkaline to litmus and divided into two portions of 2,000 c.c. each: flask (*A*) and flask (*B*) respectively. To (*B*) was added $CaCO_3$ to take up whatever free acid might be formed. Both portions were then sterilized and inoculated with *B. coli.*

In periods varying from five to ten days the contents of (*A*) and (*B*) were analyzed for indol and skatol. In no case was indol or skatol found, either in the distillate or in the original solution. An inoculation from the non-proteid medium containing *B. coli* to bouillon produced in a few days a good growth with the formation of indol.

From these experiments it would seem that indol is not formed synthetically, but in ordinary culture media is a result of the decomposition of the albuminous material present. Long-continued growth of *B. coli* on a non-proteid medium I believe will give a test for indol, since the death of many micro-organisms will leave an albuminous material in the medium.

The Sterilization of Sewage-Filter Effluents: Earle B. Phelps.

The development of the modern, rapid processes for the purification of sewage has led to a new conception of the functions of a sewage-disposal plant, in which conception the removal of bacteria finds but small consideration. The cost of obtaining high bacterial efficiency, by means of sand filtration, is so much greater than the cost of producing an effluent which is non-putrescible, though germ-laden, that the former can not as a rule be employed in the treatment of the sewage of large cities, unless bacterial purification is imperative. In certain cases, as for example where important shell-fish industries are threatened, it does become necessary to consider bacterial as well as chemical purification. As an alternative to treatment on sand, either as the chief, or as a supplementary process,

chemical sterilization of the rapid filter effluents has been proposed. Experiments carried out by the writer at the Sewage Experiment Station of the Massachusetts Institute of Technology seem to indicate that the process is much more feasible than has hitherto been supposed, and that it can, in fact, compete with supplementary sand filtration, as a finishing process for the removal of bacteria from effluents. The most suitable disinfectant thus far tried is chloride of lime or bleaching powder.

During the past summer and fall the effluent of a trickling filter, treating Boston sewage at a rate of two million gallons per acre per day, was treated with bleaching powder at a rate of five parts of available chlorine per million of effluent. The average removal of total bacteria was 99.96 per cent. and of organisms fermenting lactose in bile media 99.993 per cent. The cost of treatment for chemicals alone is $1.08 per million. The time of contact was two hours. Some special experiments in bottles upon the germicidal action of bleaching powder on *B. typhosus* showed a practical elimination of that organism in from two to four hours, the same amount of available chlorine being taken.

Results with copper sulphate were not so satisfactory. During October the application of one part of copper per million gave a reduction of 94 per cent. of the total organisms and 98.5 per cent. of the fermenting forms. The mean temperature was 56°.

In November, with a mean temperature of 46°, the removal was 79.5 per cent. and 98.4 per cent., respectively.

It was necessary to double the strength of copper, two parts per million, to restore its germicidal value to the first figure, when, in December, the mean temperature was 43°. Under these conditions the efficiency was, for the total organisms, 97.9 per cent. and for the fermenting forms, 98.8 per cent.

The cost of two parts per million of copper as sulphate is about the same as of five parts per million of chlorine as bleaching powder. The germicidal effect of the former is not nearly so great.

Some experiments, previously reported by the writer, showed that the presence of organic matter (sugar or peptone), seriously interfered with the toxic action of copper sulfate on the typhoid bacillus.

A Substitute for Potato as a Culture Medium: P. G. HEINEMANN, University of Chicago.

Ten grams of agar are dissolved in 600 c.c. water. A solution of the following salts dissolved in 200 c.c. water is then prepared:

Dipotassium hydrogen phosphate	2 gr.
Disodium hydrogen phosphate	2
Magnesium sulphate	2
Calcium chloride	2
Ammonium lactate	2
Asparagin	5

This solution, in which a fine precipitate forms, is added to the hot agar solution, 10 grams peptone dissolved, and the whole mixture filtered after the reaction, which is about 5 per cent. acid, is brought to the neutral point with phenol phthalein.

To the hot filtered solution 30 grams of starch, previously washed in water and made perfectly homogeneous in a mortar, is gradually added with constant stirring. The mixture is then brought to near the boiling point and finally weighed. The total weight should be 1,000 grams. The medium is tubed and sterilized in the autoclav for 5 minutes at 120°, and cooled in a slanting position.

The Enzymotic Properties of Diplococcus Intracellularis: SIMON FLEXNER, from the Rockefeller Institute for Medical Research.

The brief vitality of many of the cultures of *Diplococcus intracellularis* is a point of differential importance. Many strains, grown in a favorable medium, unless transplanted to a fresh medium do not survive beyond two or three days. Cultures three days old show marked degenerations, and the latter increase rapidly with age until, at the end of five or six days, or even earlier, no normal cocci persist. As degeneration progresses, loss of staining power and disintegration ensue, until, finally, staining is lost and a formless detritus remains.

The changes in the diplococcus are associated with the action of an enzyme which brings about the disintegration. This enzyme does not exhibit the usual properties of a proteolytic ferment; it does not liquefy gelatin or coagulated serum. The degree and rapidity of its action varies with its concentration; at least a heavy suspension of the cocci in salt solution, kept at 37° C., undergoes dissolution more rapidly and completely than a weaker suspension. The vitality of the cultures is associated with the degree of autolytic alterations in the suspensions; cocci in the weak suspensions survive longer than in the stronger ones. At lower temperatures—2° C.—disintegration of the cocci either does not take place at all or progresses much more slowly. Under the latter conditions more cocci survive in the strong than in the weak concentrations, although even here the vitality is a brief one.

Potassium cyanide restrains the action of the ferment which tends to disintegrate the diplococci; after removal of the cyanide dissolution sets in. Heating the diplococci to 65° C. prevents or reduces the dissolving power of the intracellular enzyme.

The enzyme acts upon the dead cocci—probably not upon the living germs. Diplococci killed by heat (50° to 55° C.) undergo autolysis; but when the cocci are killed by the addition of toluol, autolysis is accelerated. A heavy suspension of the diplococci in salt solution, under toluol kept at 37° C., may be disintegrated in four hours.

The enzyme of the diplococcus acts energetically upon other bacteria, bringing about their dissolution. It acts upon *B. typhosis, B. coli communis, B. pyocyaneus, B. anthracis, M. catarrhalis,* and to a less degree and more slowly upon *Staphylococcus aureus.*

The Stability of Tetanus Toxin: M. J. Rosenau, Hygienic Laboratory, Washington, D. C.

Some Observations on the Blood of Horses: J. J. Kinyoum, Philadelphia, Pa.

The volume percentage of the cell content of normal horse blood ranges from 30 to 46 per cent.; an average of 37.8 per cent. The administration of diphtheria toxin, causes a diminution of the red cells to an average of 30 per cent.

The anæmias induced by the toxin and the subsequent bleedings are progressive, and are in direct relation to the length of treatment. Horses treated with tetanus toxin, or with dead or living micro-organisms, also show a progressive diminution of the corpuscular content, but it is not so great as in the cases when diphtheria toxin is administered.

The danger point for all horses, beyond which the horse can not be bled, is when the cell content falls below 20 per cent. The leucocytes bear no fixed relation to the red cells; it may be as great as 1 per cent. or as small as 0.1 per cent. normal, and the same in those undergoing treatment.

There is also no relation between the cell content and the anti-bodies.

The hæmoglobin follows very closely the curve of the cells (red), both in the normal and in the treated horses.

Toxic Effects of Horse Serum.—Guinea-

pigs sensitized with horse serum begin to respond to the toxic effects of the same serum on the eighth day.

If, however, the sensitized pigs be injected with the serum of a horse which has been injected several times with progressive quantities of human blood, there is no effect.

On the contrary, if the sensitized pig be injected with the serum of a horse which has received repeated injections of horse blood rendered hæmolytic for human blood (red cells), the toxicity is not only restored, but is somewhat more toxic than the normal serum.

The toxic effect of horse serum is modified by the amount of the sensitizer; those which have received as much as 10 to 15 c.c. of serum as a sensitizer, are rendered quite resistant to the toxic dose. When the amount of the sensitizing dose is as much as one tenth the body weight, the pigs are immune.

The toxic effect of the serum is also influenced by the character of the sensitizer; for an example: If guinea pigs are sensitized by a toxin-antitoxin mixture, they are more susceptible than when given normal or antitoxic serum.

The toxic effect of a serum bears a relation to the amount given, and is influenced by the body weight.

Precipitated and dialyzed antitoxic serum is less toxic than the normal, or antitoxic serum.

Milk was found to be nontoxic to guinea-pigs sensitized with antitoxic serum.

The Alleged Rôle of Intestinal Worms as Inoculating Agents in Typhoid Fever: CH. WARDELL STILES,[1] Ph.D., D.Sc., Chief of Division of Zoology, Hygienic Laboratory, U. S. Public Health and Marine Hospital Service.

According to a theory recently advanced in France, intestinal worms (especially whipworms) form the inoculating agent in typhoid, much in the same way that fleas inoculate bubonic plague. The theory is based upon the high percentage of whipworms reported for the typhoid cases by some authors and upon the fact that intestinal worms may wound the mucosa; it is assumed that the uninjured mucosa forms an impassable barrier to the bacteria, which, however, may pass through these wounds. The theory claims that typhoid bacilli in the intestines are harmless unless parasitic worms, or some other wounding agents, are present. Accordingly, the treatment and prevention of typhoid reduces itself essentially to treatment and prevention of parasitic worms, especially of whip-worms. The theory is extended to appendicitis, cholera and certain other intestinal diseases.

More recently, the theory is also extended to include parasitic protozoa as inoculating agents in intestinal diseases, but so far as typhoid is concerned no definite statistical data are presented in support of this extension. As the fresh, warm stools should be examined to test this phase of the subject fairly, and as conditions were not favorable for such examination in the present instance, this protozoan phase of the subject could not be consistently studied in the present report.

The Washington epidemic of typhoid in the summer of 1906 presented the possibility of putting to a practical test the verminous side of this exceedingly alluring theory. The results of the study have failed to confirm the theory, for 92.5 per cent. of the patients showed no infection

[1] In making the 2,000 microscopic examinations involved in preparing this paper I have been aided by Past Assistant Surgeon Joseph Goldberger, David G. Willets, Ph.B., and Arthur E. Paterson, Ph.B.

with intestinal worms, while only 15 of them (7.5 per cent.) showed a total of 16 infections (8 infections per hundred), of which 14 cases (7 per cent.) showed whipworm infection. This represents an increase of only 1.3 infections (0.65 infections per hundred persons) over what we expected to find in the general intestinal helminthiasis, and an increase of only 1.32 per cent. over what we expected to find in whipworm infections. Considering the very wet season we have had, and especially in view of the negative findings in 92.5 per cent. of the patients, these slight increases can hardly be considered of importance.

In comparing the severity of the verminous infections (as judged by the number of eggs present) with that reported for typhoid by Guiart, in France, it was found that the Washington cases averaged only 0.47 + whipworm egg per slide, against two eggs per slide in the French statistics.

Turning to a method of indirect comparison, it is seen that while former examinations in this laboratory (for Washington, D. C., and for Connecticut) showed that the greatest percentage (13.01) of cases of whipworm infections was under fifteen years of age, in the 200 typhoid cases examined the greatest percentage (47.5) of patients fell between the ages of fifteen and thirty years, inclusive; further, the percentage of cases of typhoid does not vary parallel with the percentage of cases of whipworm infection in the other age groups.

Comparing, in reference to sexes, the statistics of whipworm infection in the world at large, and in examinations made for Connecticut and for the District of Columbia combined, with those of the 200 typhoid patients examined, it is seen that whipworms are more common in females than in males, while of our 200 typhoid cases 52.5 per cent. were males and 47.5 per cent. were females. If the comparison is restricted to the total helminthiasis of cases examined in the District of Columbia, it is slightly more favorable to the theory under discussion.

Making a similar comparison in reference to the race of patients, it is seen that in the 200 cases of typhoid under discussion (reduced to figures approximately in harmony with the general relation of the races in the population of the District) the whites were to the negroes as 55.5 to 64, while in the whipworm statistics in former examinations the whites were to the negroes as 3.75 to 9.79. The change in our summer population would account for at least a part of this excess of typhoid among the negroes.

The general conclusions are, therefore, that a study of the intestinal helminthiasis in 200 of the cases in the Washington typhoid epidemic of 1906 has not supported the theory that whipworms, eelworms, or other species of intestinal worm bear any necessary or common relation as an inoculating agent in typhoid fever; and that the view recently expressed in France to the effect that the treatment and prevention of typhoid fever practically reduces itself to the treatment and prevention of intestinal worms, especially of whipworms, does not obtain, at least so far as this locality (Washington, D. C.) is concerned. The question of the relation of protozoa as inoculating agents in typhoid is not considered in this report.

On the Absorption of the Third Serum Component: W. H. Manwaring, Indiana University.

Besides amboceptor and complement, hemolytic serum contains a third active component. This third serum component may possess hemolysis-increasing (auxilytic) or hemolysis-decreasing (antilytic)

properties, depending largely on experimental conditions.

The third component is changed in its hemolytic properties by exposure to washed blood corpuscles. Part, at least, of this change is due to the giving off into the third component of antilytic corpuscle products. No actual absorption of the third serum component by washed corpuscles has as yet been demonstrated.

On the So-called Physical Chemistry of Hemolytic Serum: W. H. MANWARING, Indiana University.

Two physico-chemical laws have been proposed for hemolytic serum: (i.) a law governing the interaction of amboceptor and complement.

When heated hemolytic serum is exposed to washed corpuscles, three phenomena take place: (i.) A hypothetical absorption of amboceptor; (ii.) A change in the third serum component; and (iii.) a giving off into the serum of antilytic corpuscle products. No measurement of the amboceptor-power of exposed heated hemolytic serum will, therefore, give any idea whatever of the amount of unabsorbed amboceptor it contains.

Similarly, the existence of an active third component, which differs in different sera prepared under identical conditions, prevents the experimental proof or disproof of the physico-chemical law proposed for the interaction of complement and amboceptor.

The physical chemistry of hemolytic serum is, therefore, beyond the present power of experimental science.

On the Chemical Inactivation and Regeneration of Complement: HIDEYO NOGUCHI, Rockefeller Institute.

On the Electric Charge carried by Toxins, Antitoxins, and Agglutinins: C. W. FIELD, Research Laboratory, New York Board of Health.

I. *An Improved Technic for Tuberculo-Opsonic Preparations.* II. *Some Suggestions concerning the Terminology of Opsonic Theory and Practise:* A. P. OHLMACHER, Detroit.

Generic Characters in the Coccaceæ: C.-E. A. WINSLOW and ANNE F. ROGERS.

The difficulties in the classification of bacteria arise partly from the variations in certain characters produced by slight changes in the environment, but chiefly from the fact that characters which appear to be constant for the individual exist in an almost infinite number of minute gradations in different races. Extreme differences in any property are completely connected by a series of intermediate forms. The best basis for a natural classification is the statistical study of a large series of individuals, which will disclose the points about which the largest number of races are grouped, which are presumably the type centers round which the organisms vary. A study of 500 cultures of cocci isolated from various sources has been made with this end in view. It has shown that the variations which exist group themselves on normal 'curves of frequency.' These show in some cases a single mode, as in the fermentation of dextrose and lactose, all the cultures studied grouping themselves about a single center, and in other cases more, as in gelatin liquefaction, where two centers exist, one for the liquefying and one for the nonliquefying forms. Chromogenesis shows four centers of variation, the white, yellow, orange and red forms being quite definitely separated.

The most significant result of this study is the fact that differences in the various characters are strikingly correlated with each other and with the source from which the organisms were derived. For example, the orange chromogens are parasitic forms which never show the sarcina grouping, are

generally Gram positive, and liquefy and ferment sugars very actively, while the red chromogens are their opposite in each respect. It is thus possible to divide the cocci into groups, each marked by the prevailing combination of certain characteristics. These groups are defined in relation to the central type about which they cluster rather than separated by sharp boundary lines; yet they certainly mark natural groups and seem to deserve generic rank.

The generic groups thus established are six in number. Streptococcus is characterized by parasitic origins (from the surfaces of the plant or animal body), feeble growth on media, occurrence of cells in chains or small groups, variable response to Gram stain (though generally a positive one), variable acid production in sugars (often reaching very high values), the absence of nitrate reduction, and the general absence of gelatin liquefaction. (The species in this genus have recently been very satisfactorily worked out, by the statistical method, by Andrewes and Horder, *Lancet*, September 15, 1906.) *Aurococcus* (n. gen.) is characterized by parasitic origin, good growth on media, orange pigment, occurrence of cells in irregular groups, generally positive reaction to Gram stain, and the formation of considerable acid in sugar solutions. Nitrates may or may not be reduced, and gelatin is either not liquefied or liquefied strongly. *Albococcus* (n. gen.) differs from *Aurococcus* in producing a somewhat heavier growth of white color, in forming somewhat more acid in sugar solution, and in a less vigorous action on gelatin. These three genera, with *Diplococcus*, which stands at the extreme end of the series beyond *Streptococcus*, may be grouped in a subfamily, the Paracoccaceæ, which includes parasitic forms producing faint to good growths, made up of chains or groups of cells, generally staining by Gram and producing considerable acid.

The rest of the cocci may be grouped together as Metacoccaceæ, including saprophytic forms, producing vigorous surface growths made up of groups of cells or packets, generally Gram negative and showing a slight action on sugars. Here belong the two generally accepted genera, micrococcus and sarcina, the first showing only irregular groups; the second, packets. In both the organisms are most abundant in air, water and earth, rather than on the body; the surface growths on media are abundant and the pigment is yellow; the Gram stain is usually negative and sugars are fermented very slightly. Gelatin is not liquefied, or liquefied somewhat slowly, and nitrates may or may not be reduced. Finally, *Rhodococcus* (n. gen.) includes the red chromogens, which show either groups or packets, rarely liquefy gelatin and reduce nitrates, if at all, only to nitrites and not to ammonia. In other respects they resemble *Micrococcus*. The group of the cocci, as a whole, shows in each character studied a gradual but continuous series of modifications from the strictly parasitic diplococcus to the strictly saprophytic rhodococcus.

The methods used in this study have been described in the *Journal of Infectious Diseases* for June, 1906, and the final conclusions will shortly be presented in the *Journal of Medical Research*.

Actinomyces of the Oral Cavity: D. H. Bergey, M.D.

The occurrence of actinomyces organisms in the oral cavity is believed to be a subject of interest, not only from the standpoint of infection starting from this place, but also on account of the possibility that these organisms may be directly injurious to the teeth.

Four organisms of actinomyces were iso-

lated from healthy mouths, and studied in more or less detail. These organisms resolve themselves in two types: the one a rather short, club-shaped, striated, branching form, and the other a long, filamentous branching form.

These organisms adhere very tenaciously to the culture media on which they are growing, and this property no doubt manifests itself in the oral cavity, where the organisms probably adhere with equal tenacity to the teeth and assist in the formation of plaques. They also have the property of breaking up a number of the carbohydrates, and in this way also exert an injurious effect through the formation of acids, thus contributing to caries.

The study of the pathogenic properties of these organisms is not yet completed.

The Growth and Toxin Production by B. Diphtheriæ upon Proteid-free Media: PHILIP B. HADLEY.

This is the preliminary report of a study whose object was to learn what constituents of proteid-free media were either favorable or necessary for the formation of toxin by *B. diphtheriæ* upon such media. The results thus far attained may be summed up as follows:

1. Very few cultures of *B. diphtheriæ*, fresh from the throats of man, will take up a growth directly upon proteid-free media.

2. Most cultures which will not at first grow upon proteid-free media may be adapted to grow upon such media. The adaptation may be accomplished by gradually diminishing the amounts of bouillon and increasing the amount of proteid-free media in a combined medium consisting of both proteid-free and bouillon until the proteid-free medium itself is reached. Each tube is inoculated from the preceding tube after an incubation of 3–5 days.

3. Whether the growth of *B. diphtheriæ* upon proteid-free media be spontaneous or the result of adaptation, there may be formed a toxin as virulent as that obtained from bouillon cultures.

4. Of the three nitrogen bases tried (asparagin, urea and glycocoll), urea seemed to be of little value, while glycocoll furnished the best growth and strongest toxin. Asparagin appeared to give better results than urea, though it was not as satisfactory as glycocoll.

5. A single morphological variety of *B. diphtheriæ* may be decidedly modifiable; and there are facts which point to the view that there may be, in the life of the diphtherial organism, what we may roughly call a cycle of adaptive forms, each one of which is best suited to a circumscribed condition of environment in which it may or may not produce a virulent toxin.

6. In all cases of growth upon proteid-free media, whether spontaneous or resulting from adaptation, it is the solid-staining varieties of the diphtherial organism which manifest the most luxuriant growth.

On the Cultivation of Spirillum Obermeieri: F. G. NOVY and R. R. KNAPP, the Hygienic Laboratory, University of Michigan, Ann Arbor, Mich.

The *Spirillum Obermeieri* has been maintained in this laboratory, since November, 1905, by a consecutive passage through rats. Although during this time many hundreds of attempts to secure cultures on artificial media have been made they have given uniformly negative results. In the defibrinated blood of infected rats, the spirilla retain their vitality for a variable length of time depending upon the stage of the disease during which the blood is drawn. If drawn during the decline stage, that is to say at a time when the organisms have reached their maximum and are beginning to decrease in numbers, the spirilla will often die out in less than 24 hours. This is due, as we have shown, to the presence of

specific germicidal bodies. On the other hand, in 'onset blood' drawn during the early stage of the disease the spirilla may live for several weeks. Thus, we have seen living spirilla in such blood kept for 30 to 37 days and have been able to infect rats with blood kept for 40 days. Moreover, we have been able to make use of this fact in shipping the virus to distant points, to Dr. Todd at Liverpool and to Professor C. Fraenkel at Halle.

In our first series of attempts at cultivating the spirilla on blood agar we were, as a rule, unable to keep the organisms alive for more than two or three days. Since then, however, we have been somewhat more successful and have kept them on blood agar for 22 to 28 days, and in some experiments now in progress they are still alive and numerous on the thirtieth day. As yet, however, no evidence has been obtained of actual multiplication *in vitro*. The organisms which are found to persist we prefer to regard as mere survivals until actual subcultures have been obtained.

The successful results obtained by Lavaditi in the cultivation of *S. gallinarum, S. Duttoni,* and *S. refringens* in collodium sacs led us to apply this method to our spirillum. With this object in view the collodium sacs were filled with rat or rabbit blood, or corresponding sera, heated and unheated, and after inoculation with spirillar blood these sacs were placed in the peritoneal cavity of rabbits. After three to seven days the sacs were removed and contents were examined with *uniformly* negative results. Apparently the rabbit is unsuited for sac cultures.

We were finally led to make the trials under conditions approachng the natural state as much as possible. For this purpose, the collodium sacs were filled with uncoagulated rat blood and after inoculation were placed at once in the peritoneal cavity of a white rat. Three days later, on removal, the sacs were found to contain active spirilla and in increased numbers. From the sacs, transplants were made to new ones and the result was equally satisfactory. The spirilla were found to be in an extremely active condition and were undoubtedly multiplying.

From this time on the transplantations were made regularly, every three or four days, from sac to sac. After a few passages the uncoagulated blood was replaced by defibrinated rat blood or by rat serum. Defibrinated rabbit blood has also been employed to some extent, but whether it will continue to be a favorable medium we are unable to state. Two sacs were inoculated each time and placed in the peritoneal cavity of a rat. Each sac had a capacity of from 2.5–3.0 c.c. and was sealed so as to leave within as little air as possible. It is a noteworthy fact that on removal from the rat the sacs are invariably greatly distended as a result of osmotic changes. Furthermore, the air which was originally present is in large part, and at times wholly absorbed.

Since October 13, the spirilla have been carried through 20 consecutive passages in 68 days, and presumably they can be kept multiplying under these conditions indefinitely. The spirilla in the sac culture are never as numerous as in the blood of rats. They rarely exceed more than 5 to 10 per field of the one twelfth inch objective, as contrasted with several hundred per field met with in the blood of rats during the maximum period of infection. The inoculation of the sac contents (blood or serum) into rats, it is interesting to note, is followed by a mild infection in which the spirilla are not much more numerous than in the sacs. Moreover, in such infection

they persist for a day or two longer than is the case with the active virus.

When the sac is allowed to remain in the rat for seven days the spirilla decrease greatly in numbers and may even disappear. In the culture sacs after removal from the rat, and kept at room temperature, the spirilla die out in a day or two.

Throughout this series the spirilla have preserved their form unchanged. They appear either as single cells (8 microns) or of double length (16 microns) but at times even longer spirals are found. The latter are the result of end to end union by means of flagella as we have heretofore shown. As in the case of blood preparations no evidence is observed of division other than transverse. One observation in this connection is deserving of special emphasis owing to its bearing upon the question as to whether spirochetes multiply by transverse or longitudinal division. In these cultures it is not unusual to find short spirals of two or three turns, and from 4 to 8 microns in length. These may occur singly or in pairs (8 to 12 microns long) showing the pale division zone. The width of the short form is the same as that of the longer cells. The occurrence of these short spirals is readily explainable as the result of transverse division. It may further be stated that the cultural spirals usually stain solid by the Romanowsky method but at times they may show granulations which to some extent may be due to granules deposited from the medium.

Sac Cultures in Rat Serum.—In view of the fact that Prowazek and others are inclined to consider spirochetes as protozoa and cell parasites it was desirable to ascertain whether or not the spirilla could be maintained in active multiplication in a clear serum. Accordingly, the spirilla were inoculated into rat serum, completely freed from corpuscles by centrifugation. Up to the present time we have effected 7 consecutive passages in such serum in the space of 24 days. At each passage a control sac containing defibrinated rat blood was placed in the rat. The serum cultures although totally devoid of corpuscles were in every respect as rich in spirilla as the blood cultures. The conclusion to be deduced from these experiments is that multiplication of spirilla may take place without any intracellular stage. The occasional presence of spirilla in a cell is to be regarded as an accident rather than as an expression of an unrecognized cycle.

A New Flagella Stain for Ps. radicola: F. C. HARRISON.

Take a loop of the mucilaginous or viscid growth from an agar culture of *Ps. radicicola* two days to several months old and spread it on a clean slide, lashing it out in slender tongues, let the film dry in air without killing or fixing, flood the film a moment with a saturated alcoholic solution of gentian violet, wash under the tap, dry between folds of filter paper and examine with the oil immersion lens. The mucilage in which the cells lie will be found deeply and evenly stained, and the bacteria scarcely stained at all, so that the preparation presents the appearance of a photographic negative. The unequal density of the protoplasm of the cells is clearly seen, as indeed it is in the living cells when examined from a hanging drop. (See photograph.)

The single polar flagellum is also clearly demonstrated by this stain since it, like the protoplasm of the cells, refuses the stain, and so it appears as a clear or uncolored streak in the surrounding deeply stained mucilage. The flagella are best stained at the margins of the films and in thin places. In parts of the film where the culture is thickly spread, the mucilage is intensely

stained and the flagella, being slender and enveloped deeply in the mucilage are not distinguished. In these parts, however, the cells are beautifully contrasted with the dark background and their internal structure is clearly shown. Saturated alcoholic solutions of methyl blue, night blue or fuchsin may be used instead of saturated alcoholic gentian violet. A film prepared and stained as above, then flooded an instant with Lugol's solution, is still more intensely and darkly stained. There is no added value to be gained by using any two or even three of these substances together.

Commercial Cultures of Pseudomonas radicicola: H. A. Harding and M. J. Prucha.

During the past two years cultures of *P. radicicola* dried on cotton have been offered commercially to the agricultural public.

At the Ann Arbor meeting we reported the results of an examination of eighteen such cultures, all of which were found to be worthless for practical purposes. A portion of these examinations were done in cooperation with Professor F. D. Chester, of Delaware, Dr. E. M. Houghton and Dr. C. E. Marshall, of Michigan, and Dr. J. G. Lipman, of New Jersey.

Results from tests of similar inoculated cotton cultures have now been given out from sixteen agricultural experiment stations and in only one case have they obtained satisfactory results from such commercial cultures.

Further discussion of these cultures would be needless but for the fact that one of the commercial companies is now putting its product upon the market in metal containers, claiming thereby to obviate the objections which had been raised against the inoculated cotton cultures packed in parchment paper and tin foil as was the case last season.

We have this season examined fourteen commercial cultures of *P. radicicola* which were in such metal containers and find them as worthless as those examined last season.

Bacteria of the Dairy Wells near Washington, D. C.: Karl F. Kellerman and T. D. Beckwith, Bureau of Plant Industry, Department of Agriculture, Washington, D. C.

Sixty wells and springs from as many different dairy farms have been examined and these are believed to fairly represent the conditions obtaining in the 800-odd other dairy water supplies. Of the 60 wells examined, 22 contained below 500 bacteria to the cubic centimeter, and of this number but six showed the presence of *Bacillus coli* in samples of one cubic centimeter. Nine showed the presence of between 500 and 1,000 bacteria to the cubic centimeter, and of these three showed the presence of *B. coli.* Nineteen showed the presence of 1,000 to 5,000 bacteria to the cubic centimeter, and of these ten showed the presence of *B. coli.* Four showed the presence of 5,000 to 10,000 bacteria to the cubic centimeter, and of these three showed the presence of *B. coli.* Six showed the presence of 10,000 to 30,000 bacteria to the cubic centimeter, and of these five showed the presence of *B. coli.*

Some Relations of Bacteria in Milk: C. E. Marshall and Bell Farrand, Michigan Agricultural College.

Influence of Temperature on the Functional Activity of Lactic Bacteria: C. E. Marshall and Louise Rademacher, Michigan Agricultural College.

Lactic Acid Bacteria in Milk: D. H. Bergey, M.D.

Conn and other authorities report the occurrence of two principal types of lactic bacteria in milk. These two types of organisms correspond to *Bacterium lactis acidi* of Leichmann and *Bacterium acidi*

lactici of Hueppe. Kruse regards *Bacterium acidi lactici* as identical with *Bacterium aerogenes,* and Heinemann is of the same opinion. Heinemann believes that *Bacterium lactis acidi* is a myth and that *Streptococcus lacticus* is the principal lactic organism in milk.

A number of samples of 'certified' and 'market' milk were analyzed in order to ascertain the nature of the lactic acid bacteria to be encountered in such milk.

The organisms encountered in certified milk were principally staphylococci and streptococci, the former type being by far the most numerous. Neither of the other types of lactic acid bacteria were found in certified milk, except in isolated instances.

The organisms encountered in market milk were principally rod-shaped organisms, and some of these were of the type of *Bacterium acidi lactici* of Hueppe.

The exact nature of all of the lactic acid bacteria encountered in market milk is still undetermined. Their sugar-splitting powers are believed to assist in a more definite classification.

Commercial Bacterial Inspection of Milk and Its Results: S. C. PRESCOTT.

The problem of providing sweet, clean, and wholesome milk to the inhabitants of large cities is one which demands attention both from the sanitary and the commercial standpoints.

Two distinct lines of action have been suggested: first, to limit the production of milk to individuals who will comply with a strict set of laws or ordinances; and second, to treat milk in some way so as to destroy the bacteria.

After more than eighteen months constant supervision of about two hundred farms I should like to present a record of some of the results of bacterial examination and farm inspection.

It must be accepted, I think, that for a long time to come the major portion of the milk consumed in a large city will be the product of the ordinary farm, handled by ordinary men, and shipped by the ordinary methods of transportation. Too sweeping demands for immediate reforms, or laws which can not at present be obeyed, will serve only to precipitate a milk famine.

In this work I have attempted first of all to visit every farm, and to give the farmer whatever help was possible by suggesting improvements in his methods or appliances, and by explaining the reasons for our inspections. Especial attention was given to the effect of cleanliness and cold. A small pamphlet on clean milk, written in very homely language, has been sent to each producer.

I have graded the milk from these farms for purposes of convenience into six groups, according to the number of bacteria, as follows:

Grade A, Below 10,000 bacteria per cubic centimeter.

Grade B, 10,000 to 50,000 bacteria per cubic centimeter.

Grade C, 50,000 to 100,000 bacteria per cubic centimeter.

Grade D, 100,000 to 250,000 bacteria per cubic centimeter.

Grade E, 250,000 to 500,000 bacteria per cubic centimeter.

Grade F, Above 500,000 bacteria per cubic centimeter.

The percentage of samples exceeding 500,000 fell from 30.5 in June, 1905, when inspection began, to 2.3 in May, 1906; but with the advent of hot weather and the scarcity of ice, rose, as would be expected, to a maximum of 12.1 per cent. in July, 1906, but dropped again as cooler weather approached.

On the other end of the scale, the percentage of samples containing below 10,000 gained from 2.0 in June, 1905, to 37.3 per

cent. in February, 1906, and at no time since has it fallen below 22.2 per cent.

The percentage of samples containing fewer than 50,000 has never fallen below 50 since September, 1905, three months after inspection work began.

Experiments on the Germicidal Action of Fresh Cow's Milk: P. G. Heinemann.

The question whether fresh cow's milk contains bactericidal substances or not has been answered in the affirmative by Fokker, Ehrlich and Brieger, Park, Kolle and his coworkers, Hunziker, Hippius, Koning, and others. In opposition to this, Moro, Honigmann, Basenau, Stocking and others have denied the existence of such substances.

Experiments by the writer carried on by inoculating raw milk and milk heated to 56° C. and to the boiling point indicate that fresh cow's milk contains germicidal substances, although to a smaller degree than blood serum. Milk was obtained directly after milking and divided into three portions, one of which was heated either to boiling or kept at 56° C. for 30 minutes. The second part was left without further treatment, and then both heated and raw milk were inoculated with suspensions of bacterial cultures. The third part was kept as control. Plates were prepared from suitable dilutions and the colonies counted after two days incubation at 37° C. The three lots of milk were kept at room temperature and plating repeated at regular intervals. The results lead to the following conclusions:

Conclusions.—1. Raw milk contains substances which are germicidal to a pronounced degree for some species of bacteria. (*B. coli, B. dysenteriæ* (Flexner), *B. fluorescens, non-liquefaciens.*)

2. Raw milk contains substances which have slight germicidal action on some species of bacteria. (*B. violaceus, B. choleræ suis, B. prodigiosus* (laboratory culture), and some saprophytes isolated from milk.)

3. The germicidal substances in milk do not act strongly on *B. fluorescens liquefaciens, B. typhosus,* some varieties of *B. prodigiosus* and *B. proteus,* but the multiplication of these organisms is restrained for a limited period.

4. The germicidal action of cow's milk persists for more than 5 hours and less than 7 hours at room temperature.

5. The germicidal action of cow's milk is destroyed by keeping milk at 56° C. for 30 minutes or by heating to the boiling point.

6. The germicidal substances in cow's milk are less powerful than those of blood serum, but are inactivated under similar conditions. The relative concentration of these substances varies in milk from different animals.

S. C. Prescott,
Secretary

SCIENTIFIC BOOKS

Experimentelle Beiträge zur Morphologie. Hefte I. and II. Herausgegeben von Herman Braus (Heidelberg). Leipzig, W. Engelmann. 1906.

The study of experimental morphology, which in recent years has attracted so large a body of enthusiastic students, has been taken up very largely from the dynamic or physiological point of view. This is indicated by the title of the journal most specifically devoted to this line of work—W. Roux's 'Entwicklungsmechanik der Organismen.' Yet, although some physiologists, like Pflüger and Loeb, have done much to stimulate interest in this direction, it is chiefly to professional zoologists and anatomists that the subject has appealed, while the immediate predecessors and many of the contemporaries of these same zoologists and anatomists have been interested rather in phylogenetic and historical than in dynamic biological questions.

The purpose of these Beiträge is to emphasize the value of experimental and accidental

teratology for the elucidation of phylogenetic morphological problems. This purpose is set forth in the paragraph which concludes a preface to the Beiträge in which Braus dwells on the distinctions between the historico-genetic and the dynamic aspects of biological problems. "The close relations," he says, "of this branch of experimental embryology to the program of 'Gegenbaur's Morphologisches Jahrbuch' led me, by agreement with the editor and publisher of this journal, to embody my 'Experimentelle Beiträge zur Morphologie' in it and thus to certify their appurtenance to the life work of the founder of modern morphology. On the other hand, in order to emphasize the unity of purpose of the 'Experimentelle Beiträge' and to make them more readily accessible to those who care especially for the broad aspects of experimental embryology and for its relations to the physiology of development, the Beiträge following their appearance in the Jahrbuch are to brought out in the form of separate Hefte. It is anticipated that several Hefte can be bound into a volume. Should they grow in general into a collection for experimental-embryological work which has the historic-morphological problem as its aim, yet in which sight is never lost of the relations of the facts discovered to the other aspect of biological investigation, that of the physiology of development, there may be added other volumes to the series and the progress here aimed at may prove lasting."

Thus far two Hefte have appeared. These contain reprints from the *Morphologisches Jahrbuch* of articles on experimental embryology and teratology by Braus and one of his pupils. Bd. I., Heft 1, is given up to the preface above mentioned, and to a paper entitled 'Ist die Bildung des Skeletes von den Muskelanlagen abhängig.' A series of experiments on the developing pectoral fin of sharks leads Braus to conclude that in the selachian fin the skeleton develops independently of the musculature but that parts of the skeleton are dependent upon other parts for stimulus to development.

In Bd. I., Heft 2, there is an article by O. Bender entitled 'Zur Kenntnis der Hypermelie beim Frosch.' This gives a description of the external form and of the skeletal muscles and nerves of a left supernumerary hind leg of a frog. Deductions are drawn as to the probable cause of the anomaly.

The chief paper in this Heft is one by Braus on the 'Vordere Extremität und Operculum bei Bombinatorlarven' in which Braus shows that although normally the fore limb at a certain stage of development appears to break through the operculum yet, if no fore-leg is developed, there is none the less an aperture formed as if the leg were present. The developing limb has the power to force its way through a covering of skin artificially formed above it. The results of the experiments are considered from the point of view of phylogenetic morphology.

All anatomists acknowledge the great help which the study of normal embryology has been in the development of a science of structural form. That accidental and experimentally produced abnormality of structure may help to clear up obscure fields of anatomy has been abundantly proved of late years. Abnormalities and variation in the structure of man and some other animals have long been used as a basis for phylogenetic speculation. It is not improbable that teratology controlled through experiment may throw interesting light on this aspect of biology. We trust that the 'Beiträge' may serve to stimulate more work in experimental embryology in its morphological aspects. On the other hand, it is to be hoped that vague speculation will not take up an undue amount of the pages devoted to the subject. C. R. B.

Rhythmical Pulsations in Scyphomedusæ. By ALFRED G. MAYER, Director of Department of Marine Biology of the Carnegie Institution of Washington, Tortugas, Florida. Pp. 62, with 2 plates and 36 text figures. Washington, D. C. The Carnegie Institution. 1906.

Among the wealth of new material for investigation which the Carnegie Station at Tortugas has placed at the disposal of the scientific public Dr. Mayer has discovered that a small scyphomedusæ, *Cassiopea xamachana*,

offers exceptionally favorable material for the study of rhythmic pulsation; and to the reactions of this species he devotes the greater portion of his paper on rhythmical pulsation. In this species he has discovered a new and very interesting way in which rhythmical pulsations may be maintained. In general, in medusæ, the pulsations are originated in the margin, which contains the sense organs and the greater part of the nervous system. If this margin be cut off the central part of the disc does not, in general, continue to contract in sea water. Romanes, however, found that by passing a weak constant current through such an emarginated disc rhythmical contractions could be kept up in *Aurelia;* and Loeb has found that the central part of both *Gonionemus* and *Polyorchis* can be made to pulsate continuously in appropriate chemical solutions, which are different for the two forms. Mayer has found that if in *Cassiopea* the marginal sense organs are removed, the remainder of the disc does not pulsate in sea water. If from this disc a ring of tissue be cut, or if the disc be cut in other ways, so that a closed circuit of uninjured tissue be left, in which an impulse can pass continuously from one point, around the circuit, to its point of origin, without passing over any portion of its path twice, it still does not pulsate. If, now, a disc which has been cut in this way is strongly stimulated electrically, mechanically or chemically, a wave of contraction starts from the point of stimulation, and passes with constantly diminishing intensity around the circuit. When it reaches its point of origin it is suddenly reinforced, and starts around the circuit again with renewed vigor. In this way a perfectly regular series of contractions is originated which keeps up indefinitely. The rate at which these contractions follow each other depends upon the length of the path from the point of origin around the circuit and back again. If, now, during such a series of pulsations, the ring of muscular tissue be cut across so that there is no longer a closed circuit, the pulsations stop instantly. The point from which the pulsations start does not always remain at the original point of stimulation, but may shift to some other place. In such cases, and when the series of pulsations has been started by an unlocalized stimulus, there is a decided tendency for the point of origin of the pulsations to be located in the geometrical axis of symmetry of the figure into which the disc has been cut.

Although Dr. Mayer does not discuss this point, phenomena of this kind have a special interest for us on account of the analogy which they may furnish for some of the processes going on in the central nervous system; and for these reasons it is to be hoped that the cause for the characteristic location of the point of origin of the pulsations, the nature of the reinforcement given to the wave of contraction, the nature of the reciprocal influence of two points of origin on each other, and similar questions will be still farther studied.

Many other questions, which it will be impossible to discuss here, are also investigated. Among them the rôle of the various salts of the sea water in stimulating and inhibiting the pulsations is considered, but as these chemical questions are not considered from the point of view of the modern general physiology, which is based upon physical chemistry, they are less satisfactory than other portions of the paper. Frank W. Bancroft

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SCIENTIFIC JOURNALS AND ARTICLES

The Journal of Experimental Zoology, Vol. IV., No. 1, February, 1907, contains the following papers: 'Abnormal Development of Toad Ova Fertilized by Spermatozoa exposed to the Roentgen Rays,' by Charles R. Bardeen. 'An Ecological and Experimental Study of Sarcophagidæ with Relation to Lake Beach Debris,' by William B. Herms. This is a study of the conditions presented by the flesh-feeding fly-larvæ, and the adaptations which have resulted from a certain amount of isolation and apparently fairly regular periodicity of food (fish) supply in the particular locality studied, and determination of minimum food supply required for the maturity of individuals as well as the optimum and maximum periods of feeding. 'Rejuvenescence as the

Result of Conjugation,' by Sara White Cull. Experiments were made to determine (*a*) whether conjugation always produces rejuvenescence and (*b*) whether the fertilization resulting from conjugation is or is not mutual. Conjugating pairs of *Paramecium caudatum* were isolated and the individuals, after they had been separated, were isolated and counted at intervals for a month. The statistics gathered show that (*a*) conjugation frequently fails to produce rejuvenescence in either conjugant and (*b*) that conjugation, among the infusoria, is not mutual and there are strong indications that it is incipient fertilization as seen among higher forms. 'Artificial Parthenogenesis in Thalassema mellita,' by George Lefevre. An investigation of artificial parthenogenesis in *Thalassema mellita* has shown that the unfertilized eggs of this worm can be induced to develop into actively swimming trochophores by immersion for a few minutes in very dilute solutions of both inorganic and organic acids. Nitric, hydrochloric, sulphuric, carbonic, acetic and oxalic acids were used successfully, and in favorable experiments 50–60 per cent. of the eggs developed into swimming larvæ that were hardly distinguishable from normal trochophores of a corresponding stage. The parthenogenetic development in many cases involves a perfectly normal maturation, a more or less regular cleavage, and the usual processes of differentiation leading up to the formation of the normal larva. The reduced number of chromosomes (twelve) persists when the maturation has been normal, and has been repeatedly counted even in late blastula and gastrula stages. Differentiation of the egg does not occur in the absence of cleavage, and all ciliated bodies, whether normal or abnormal, possess a cellular structure. 'Concerning the Theory of Tropisms,' by Jacques Loeb. 'The Mechanism of the Galvanotropic Orientation in Volvox,' by Frank W. Bancroft. O. P. Terry's result, showing that volvox colonies subjected to a bright light swim to the cathode, while those subjected to a dim light or darkness swim to the anode was confirmed. This difference was found to be due to a reversal of the pole at which the galvanic current acts. In anodic colonies the galvanic current stops the flagella current on the anode side of the organism. In cathodic colonies the orientation is produced by stopping the flagella current on the cathodal side. Pressure on anodal colonies reverses the pole at which the galvanic current produces its effect.

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

THE 633d meeting was held on April 13, President Hayford in the chair.

Professor Newcomb discussed the question of the variability of the sun's radiation, giving the results of a statistical investigation on that subject. The line of investigation was directed upon the point whether there is any tendency to synchronism between spells of high and low temperature in widely separated regions of the earth. The material included annual mean temperatures, as observed from 1820 to 1904, and deviations during terms of ten days, and of one month, from 1872 until 1904. The general conclusion was that there were no well-marked deviations other than those which resulted from local causes, and that when these were duly allowed for, the temperature of the earth at large remained constant within a fraction of a degree. The only appreciable indication of any cosmical cause affecting the whole earth was in the monthly deviations. So far as the investigation had been carried, these indicated that there really was a deviation, which could be accounted for by a change in the sun's radiation from month to month, sufficient to change the temperature of the equatorial regions by an average amount of about one third of a degree centigrade. But even this small change may be due to the trade winds and other great movements of the air, by which a body of air colder or warmer than the normal is carried from one region to another within the monthly limits. The only ascertained law of change was that of the sun-spot period. The result reached by Köppen, that the temperature of the earth generally was somewhat higher the fewer the sun-spots,

is confirmed; but the amount of the change is less than one half that found by Köppen, the deviation being only 0°.13 C. on each side of the mean.

The general conclusion was that if the sun's radiation of heat is variable at all, the amount is too small to have any appreciable meteorological effect.

It was distinctly set forth that the research referred only to the radiation of heat, and not to the electric radiations which are known to proceed from the sun, which vary from time to time and which are related to magnetic storms, and perhaps also to the atmospheric electricity.

In the course of the general discussion of Professor Newcomb's paper, Dr. Abbott exhibited some diagrams showing the variations of terrestrial temperatures corresponding to certain variations of solar radiation as derived from bolometric measurements at a mean latitude of 39°.6 N. He called attention to other curves he had constructed showing the annual temperature variations observed at coast and inland stations in the United States, the variation at the inland stations being three times that at the coast station. Another curve was shown of an hypothetical earth (earth assumed as a black body) which truly followed the variation of solar radiation.

At the conclusion of the meeting Dr. Abbott called attention to a disc photometer which he had recently designed, and which he afforded the society the opportunity of seeing in operation.

R. L. Faris,
Secretary

The Geological Society of Washington

At the 189th meeting of the society held in the Cosmos Club on Wednesday evening, March 20, the president announced the receipt of a letter from the Washington Academy of Sciences stating the intention of the academy to erect a building to be devoted to the use of the scientific societies of Washington, and asking that the Geological Society indicate the amount of room needed and how much it would contribute to the building fund. Action concerning the matter was deferred to the next meeting.

Regular Program

The following papers, illustrated by lantern slides, were presented:

Some Features of the Geology of Magdalena and Black Range Region, New Mexico: C. H. Gordon.

The area to which this paper relates lies along the west side of the Rio Grande Valley, extending from near the north line of Socorro County southward to Deming. The valley of the Rio Grande here is from twelve to forty miles in width and is bounded on the west by several parallel mountain ranges which constitute the southeastern border of the Great Plateau country as outlined by Dutton. In the Black Range a nearly complete sequence of Paleozoic rocks occurs, resting upon the eroded surface of pre-Cambrian granites and schists. In the Magdalenas the Lower Carboniferous limestone rests directly upon greenstone schists and granites. Rocks of Cretaceous age occur in a number of places, resting upon the eroded surface of the Pennsylvanian series. No Tertiary sedimentaries were observed, this period being characterized by extensive eruptions of andesite, and rhyolite. Intrusions of monzonite and quartz-monzonite and their associated porphyries are common, and with them occur also granite porphyries, and rocks of basic composition like diabase. Remnants of extensive flows of basalt occur, resting upon the mesa gravels filling the valley.

Structurally the region is characterized by block faulting. With the uplift of the plateau on the west there appears to have been a relative sinking of the belt now represented by the Rio Grande Valley, with crustal breaking and readjustment giving rise to tilted blocks which appear here and there as elevations rising out of the general plain level. Extensive erosion has supplied from the adjoining slopes a vast amount of débris which covers the valley in places to a depth of from 1,000 to 2,000 feet.

At the north end of the Magdalena range near the town of Magdalena are located the lead and zinc mines of Kelly. The ores occur along the bedding planes of carboniferous limestones which have a westward inclination

of 30° to 40°. The sedimentary block which constitutes the back (west) slope of the mountain is affected by numerous faults, the chief of which extend north and south, and constitute the main fault scarp on the east side of the range. At the foot of the range on the west side, the sedimentary rocks are cut off by quartz-monzonite-porphyry the intrusion of which appears to have furnished the solutions from which the ores were derived. Of interest in this connection is the occurrence of pyroxene intergrown with amphibole and specularite together with quartz and calcite along the boundaries of the sulphide ore bodies with the inclosing limestone.

The Santa Maria Oil District, California: RALPH ARNOLD.

The Santa Maria oil district, comprising the Santa Maria, Lompoc and Arroyo Grande fields, occupies the central and northern portions of the Lompoc and Guadalupe quadrangles, northern Santa Barbara County, and the southern part of the San Luis quadrangle, southern San Luis Obispo County.

The San Rafael Mountains, 2,000 to 6,000 feet high, trend northwest across the northeastern portion of the area, while the Santa Ynez Range skirts the southern. Occupying the angle between the two ranges are low hills and broad valleys. The developed fields cover the flanks of two of the low ridges in this basin region, the main or Santa Maria field proper being located on Graciosa Ridge, about eight miles south of the town of Santa Maria.

The formations involved in the geology of the district include the Franciscan (Jurassic) sandstone, shale, glaucophane schist, jasper and intruded serpentine; Knoxville (lower Cretaceous) conglomerate, sandstone and shale; pre-Monterey (which may include both Cretaceous and older Tertiary) conglomerate, sandstone and shale; Sespe (Eocene or Oligocene) sandstone; Vaqueros (lower Miocene) conglomerate, sandstone and shale; Monterey (middle Miocene) diatomaceous and clay shale and volcanic ash; Fernando (Miocene-Pliocene-Pleistocene) conglomerate sandstone and shale; and Quaternary gravel, sand, clay and alluvium.

Two structural systems prevail in the district, those features in the northeastern portion striking northwest and southeast, those in the southern portion striking east and west; while in the intervening region are features trending in a direction intermediate between the two. Few faults of importance were noted in the field. The productive territory lies in a region of more or less gentle folds in the central part of the area, the wells usually being located along or near anticlines.

The wells vary in depth from 1,500 to over 4,000 feet. In the Santa Maria and Lompoc fields they obtain their oil from zones of fractured shale or sandy layers in the lower portion of the Monterey (middle Miocene) formation. The production of the individual wells varies from 5 to 3,000 barrels. The gravity of the oil ranges from 19° to 35° Baume, the yield from the greater part of the field being about 25° to 27°. In the Arroyo Grande field the oil comes from sandstone at the base of the Fernando and is of 14° gravity.

Notes on the Geology of Japan: ROBERT ANDERSON.

This paper gave an outline of the general topographic features and geological structure of the Japanese islands. To sum up the main points: The ground plan of the group was laid during the earliest geological times, Archæan gneisses and schists and a great thickness of Paleozoic sedimentary, metamorphic and igneous rocks being the basement complex. Mesozoic, Tertiary and Quaternary formations are wide-spread and diversified, having the character of a superstructure over an older land mass. The island chain is continental in character, not chiefly of volcanic origin, although volcanic activity has always been a feature of its history. It is a country of long-continued and great geological activity, as shown by the variety of its rocks, by the presence of a thick column of strata representing the earliest and latest as well as intermediate times, by the metamorphism and excessive disturbance of these strata as the result of repeated movements, by the presence of many igneous intrusions and volcanic remains which show that similar igneous forces as are at work

to-day have always been active, and by the modern land movements forming depressed broken shore lines and terraces and keeping a fairly new face on the topography of areas occupied by the oldest rocks, these movements being illustrated in the every-day earthquakes to which Japan is subjected.

In a number of points a similarity exists between the geology of Japan and that of the western coast of America: In the existence in both California and Japan of a somewhat similar thick basement complex; our Franciscan is probably Jurassic in age; the Japanese terrane with which it might be compared is supposedly Paleozoic; both formations are intruded by similar serpentine of Jurassic or Cretaceous age. In the apparent Mesozoic age of the wide-spread and important intrusions of granite. In the similarity of the old and recent faunas and floras, as has been partially brought out by a few paleontologists. In the presence in both countries of a large amount of schist formed of the blue amphibole glaucophane, whereas it is rare in all but a few places elsewhere. In the fact that both countries have been long coastal belts of volcanic activity during Tertiary and Quaternary times, the thickness and wide extent attained by the Tertiary tuffs in Japan being remarkable. In the recency of earth movements, as shown in the multitude of earthquakes, the presence of upraised Quaternary deposits and marine terraces, and by the evidence of present oscillations in the level of the coasts. And the resemblance holds good particularly in the tremendous land-building activity of the Tertiary on both sides of the Pacific, contributed to by tectonic movements and the rapid denudation of land areas and deposition along narrow belts. This feature is illustrated by the great thickness of the Tertiary formations, their structural disturbance and their lithologic alteration.

Ralph Arnold,
Secretary

THE CHEMICAL SOCIETY OF WASHINGTON

The 174th regular meeting of the Chemical Society of Washington was called to order by President Fireman, on April 11, at 8 P.M.

A committee, consisting of Messrs. L. M. Tolman, F. K. Cameron and S. S. Voorhees, was appointed to consider the advisability of cooperating with the Washington Academy of Science relative to the erection of a suitable building to serve as a home for the academy and all the affiliated societies.

The president of the society was invited by the commissioners of the D. C. to confer with a committee appointed to consider the milk supply of the district.

S. S. Voorhees read a paper on 'Buying Coal under Specifications.' The speaker said that the present specification was the outgrowth of six years' experience in the purchase of coal by the Treasury Department. The specification requires the bidder to state the name and location of mines from which deliveries will be made with per cent. of ash in dry coal and B. T. U. in coal as delivered; the price paid for deliveries is based on price stated in proposal corrected for heat value and ash found in average sample representing deliveries above or below standard established by bidder.

W. O. Robinson read a paper on 'The Solubility of Calcium Sulphate in Aqueous Solution of Sodium Sulphate and Sodium Chloride at 25°.' At 25°, Cameron and Seidell found the solubility curve for the system sodium sulphate, sodium chloride and water to consist of three branches representing solution in equilibrium with sodium sulphate decahydrate, anhydrous sodium sulphate and sodium chloride.

Calcium sulphate was introduced into this system and, after complete reaction had taken place, was found to occur in the solid phase as gypsum at the sodium sulphate and sodium chloride ends of the curve. In intermediate concentration, however, the solid phase containing calcium occurred as fine needle-like crystals. As these were decomposed by washing, ordinary methods of analysis could not be used. By the double triangular diagram method, this calcium salt was found to be represented by the formula $3Na_2SO_4 \cdot 2CaSO_4$. This conclusion was fully confirmed by the zero method and by precipitation with a weighed amount of calcium sulphate.

H. E. Patten's paper on 'Energy Changes accompanying Adsorption' showed that absorption could be looked upon as a special case of adsorption by combining the inbibition effect with the adsorption effect where both take place in the fine pores of a cellular body. Where the pores become very minute we may think of a solid solution as a limiting case of such an absorption effect. A résumé of the energy changes accompanying absorption was given.

On May 1, a special meeting was held at the George Washington University Lecture Hall. This was the first of a series of meetings to be held for the discussion of sanitary matters. W. C. Woodward, M.D., health officer of the District of Columbia, spoke on the 'Health Department of the District of Columbia, its Functions and Organization.' The speaker gave a history of the department; its relation to other branches of the city government; and told about the work of enforcing the smoke-, food-, marine products-, milk- and slaughter-house-regulations.

J. A. LECLERC,
Secretary

BUREAU OF CHEMISTRY,
WASHINGTON, D. C.

DISCUSSION AND CORRESPONDENCE

ANOTHER WORD ON THE VULTUR CASE

IN SCIENCE of May 3 (pp. 708, 709) Mr. Stone makes a brief reply to my article on how the 'first species' rule works in determining genotypes in ornithology.[1] Inasmuch as he makes no attempt to traverse the principal positions there taken, it is perhaps almost ungracious again to open the subject. For the expert no reply is necessary, but the general reader may be misled by some of his statements.

Of the seven cases he would throw out from my list of twenty-one generic changes made necessary by the first species rule, *Spinus* may be saved by the rule of tautonomy, and *Colymbus* may be excluded by the provision exempting Linnæan genera from its scope. Respecting the other five cases, Mr. Stone and I simply hold different views, and the details need not be here discussed.

In regard to the 'several inconsistencies' he claims to have pointed out in the *Vultur* case, one I frankly admitted, and explained as a pure blunder; the rest of the 'several' exist only in his imagination. While *gryphus* is the type of *Sarcorhamphus,* founded in 1806, it did not become its type at that date; it did not become the type till the other two of the original three noncongeneric species had been removed, and thus does not in the least affect the type of *Vultur* as determined by my elimination. By the current usage of all 'experts' in elimination—except Mr. Stone—*aura* and *papa* both go out at 1816, instead of the latter at 1854, as claimed by Mr. Stone. So this 'excellent illustration of the complexity of the elimination method and the opportunities it offers even to experts to fall into errors' fails completely to illustrate anything except Mr. Stone's ideas about methods of elimination.

J. A. ALLEN

NEW YORK,
April 8, 1907

[1] See SCIENCE, N. S., Vol. XV., No. 640, pp. 546–554, April 5, 1907.

SUNSPOT ZONES

TO THE EDITOR OF SCIENCE: It occurs to me that Sporer's law of the sunspot zones might be accounted for in this way: When the last ring of planetary material was detached, it seems likely that a part of the material of the sun should have been lifted with this ring, only to fall back into the sun after the moment of parting. In the gaseous mass of the sun this may be supposed to have produced a system of waves of ring-like shape, whose velocity of propagation might be such as to pass from latitudes 30 to 5 in fourteen years. Their paths might perhaps be such as to come nearest to the surface in the latitudes where the sunspots have their maxima.

Any such progressive disturbance near the surface of some deep layer in the sun might be sufficient, in connection with the deflective influence of the sun's rotation, to occasion surface eddies, 'cyclones' as suggested by Faye. Or, they might cause 'eruptive' phe-

nomena in the unstable static conditions of the outer layers of the sun.

I am not aware that such a suggestion as this has ever been made to account for Sporer's law. Of course I see many objections to it. The improbability of such waves long retaining their shape, and the observed absence of sun spots in the north hemisphere from 1672 to 1704, suggest themselves as obstacles.

J. A. Udden
Rock Island, Ill.

AFRICAN BASKETRY WEAVES

A large collection of ethnological specimens recently received by the Museum of Natural History, New York city, contains a selected series of baskets from the Barotse and Bechuana tribes. These baskets compare favorably in technique and finish with those of California and, what is of special interest, present all the typical weaves known in America. Among the Barotse baskets alone we find the following kinds of woven basketry: wicker, checker, twill, wrapped, plain twine, open twine, twilled twine, and the California 'ti.' Also in coiled basketry, one rod coil, grass coil closely covered, also with foundation showing bifurcated coil closely covered, also with only lines of stitching and coil without foundation.

The more elaborate manipulation of warp elements or materials in general, seems not to be practised, for there are neither cross-warp checkers nor cross-warp twines in the collection. The edges, while of all types, represent rather the refined variations. The thought of solidity or stability seems to have been the main idea. This is particularly well illustrated in the large rope coil and one-rod foundation coil chests and storage baskets. The technic is perfect and with the close-fitting lids give exceptional protection to grain or other contents. Strengthening by bands of the 'ti' weave, a technic heretofore thought to be limited to the Pomo Indians of California, is found; also an unusual wrapped twine, with the horizontal warp on the outside, like some Aleutian burden baskets.

The decorations in color occur chiefly in coil baskets. The color of the designs is uniformly black.

The main point of interest is that within a definite ethnic area of South Central Africa an aboriginal people practise basketry in which are found practically all of the typical weaves known to the world.

Mary Lois Kissell
American Museum of Natural History,
New York City

THE RECUPERATIVE POWER OF ITALIAN AND ENGLISH WORKMEN

To the Editor of Science: I am afraid that the statements contained in the letter of Mr. Joseph Y. Bergen,[1] as to the recuperative power of Italian and English workmen may induce some readers to unwarranted generalizations.

A statement of the kind would have more value if a comparison were made between the diet and the conditions of people of the *same race* and the same locality, provided in each case there existed a sufficiency of the articles of diet.

On the other hand, it is a known fact, that, generally speaking, the rural population of Europe has better recuperative powers than the inhabitants of the cities, although the latter eat much meat, while the country people live almost exclusively on a vegetable diet, meat being considered too expensive.

L. H. Baekeland

SPECIAL ARTICLES

SOME LATENT CHARACTERS OF A WHITE BEAN[2]

In order to secure material to display as simple illustrations of Mendel's laws of dominance and gametic purity, I made reciprocal crosses last year (1904) among four different varieties of the common bush bean. These varieties were the 'Prolific black wax,' with purple-black seeds, the 'Ne plus ultra' with yellow-brown seeds, the 'Long yellow six-weeks' with seeds of a light greenish-yellow color, and the 'White flageolet,' whose seed-coats are wholly without pigment, being transparent when saturated with liquids, but nearly white because of the inclusion of air when dry.

[1] Science, May 3, 1907, page 709.

[2] Read before the Botanical Society of America, at New Orleans, December, 1905.

I have this year (1905) the first generation of the hybrids, and all the crosses behaved in the expected way except those in which the 'White flageolet' entered as one of the parents. The crosses between black and brown, black and yellow, and between brown and yellow showed in every case the complete dominance of the darker pigment over the lighter. Thus, the first-generation hybrids between black and brown beans and those between black and yellow were in every case indistinguishable in color from the black parent, whether the black bean supplied the egg or the sperm. Similarly the hybrids between the brown and yellow were in each case not to be distinguished from the brown parent. But the crosses between each of these three pigmented varieties and the 'White flageolet' gave F_1 hybrids so different from either parent that, if unknown, their origin would never be guessed. These seemingly anomalous hybrids were quite indistinguishable from one another, whether the pigmented parent was black, brown, or yellow. They were characterized by a dark purple pigment, and by an aggregation of the pigment-bearing cells to form a mosaic or mottled surface. Although these hybrids were quite unexpected, it was recalled that Tschermak[2] had secured similar results in a number of cases, and Emerson[3] describes them also in crosses between 'Ultra' and 'Navy,' this being presumably the very same cross that I present here as 'Ne plus ultra' × 'White flageolet.'

Very similar phenomena have been seen by Tschermak,[4] Bateson,[5] and Lock[6] in peas, by Tschermak[4] and Bateson[5] in stocks, by Bateson[5] in sweet peas, by Correns[7] in *Mirabilis*, by Cuénot[8] in mice, and by Castle[9] in guinea-pigs. It is not because of the newness of the phenomenon, therefore, that I draw attention to the subject, but for the purpose of discussing the phenomenon of latency in the light of the accumulated data.

The appearance of hereditary characters which are not traceable to the immediate ancestry offer the most difficult problems with which the student of heredity must deal. These characters may be recognizable as having belonged to the more remote ancestry of the form in question, *i. e.*, they are atavistic, or they may be wholly new. Sometimes they occur under known conditions, at other times there is no clue to the causes upon which they may depend.

These bean hybrids which possess characters not seen in either parent furnish good examples of latency and if we can determine whence the new characters came we shall be far advanced toward a correct conception of latency. Taking, for instance, the hybrids between the yellow and white and between the brown and white, two characters may be recognized as new, *viz.*, the dark pigment and the mottled color-pattern. The fact that the very same characters appear in the hybrid offspring, no matter what the character of the pigmented parent, leaves little doubt that both of these new characters are traceable to the white parent, and we should seem to be warranted in saying that this white bean con-

[2] Tschermak, E., 'Weitere Kreuzungsstudien an Erbsen, Leukojen und Bohnen,' *Zeitschr. Landw. Versuchsw.*, **7**: 533–638, 1904.

[3] Emerson, R. A., 'Heredity in Bean Hybrids,' Ann. Rept. Agr. Exp. Sta. Nebraska, **17**: 33–68, 1904.

[4] Tschermak, *loc. cit.*

[5] Bateson, W., Saunders, Miss E. R., Punnett, R. C., 'Experimental Studies in the Physiology of Heredity,' Second Report to the Evolution Committee of the Royal Society, London, 1905.

[6] Lock, R. H., 'Studies in Plant Breeding in the Tropics,' *Ann. Roy. Bot. Gard. Perideniya*, **2**: 299–356, 1904.

[7] Correns, C., 'Ueber Bastardirungsversuche mit Mirabilis Sippen,' *Ber. d. d. Bot. Ges.*, **20**: 594–609, 1903; 'Zur Kenntniss der scheinbar neuen Merkmale der Bastarde. Zweite Mittheilung über Bastardirungsversuche mit Mirabilis Sippen,' *Ber. d. d. Bot. Ges.*, **23**: 70–85, 1905.

[8] Cuénot, 'Le loi de Mendel et l'hérédité de la pigmentation chez les souris,' *Arch. Zool. expér. et gén.*, —: 27, 1902; 'L'hérédité de la pigmentation chez les souris' (2me note), *Arch. Zool. expér. et gén.*, 4 Se., **1**: 33–41, 1903.

[9] Castle, W. E., 'Heredity of Coat-characters in Guinea-pigs and Rabbits,' Publ. Carnegie Institution of Washington, No. 23, 78 pp., Feb., 1905.

tains latent purple and latent mottling. Tschermak[10] takes just the opposite view, however, and would say that the purple mottling is latent in the pigmented bean, and that the white bean acts simply as a releasing agent which allows the latent character to become manifest. Bateson[11] also subscribes to the same view. On Tschermak's hypothesis it would appear to me a remarkable coincidence that the black, brown and yellow varieties should all contain the same latent characters, and I am forced to the conclusion just stated, that the novelties which appear in these hybrids are directly derived from the *white* parent. The new characters thus lose the mystery that otherwise invests them. They appear not as released prisoners or awakened sleepers, which had for some inconceivable reason remained inactive, but are *combination* phenomena.

The color characters of these beans are not dependent upon a single pair of units, but upon three pairs, *viz.*:

1. Pigment *vs.* no pigment.
2. Modifier which changes pigment to purple *vs.* no modifier.
3. Mottled color pattern *vs.* self color.

Of these three characters, the brown and yellow beans contain only the dominant pigment character and might be represented by the formula, *Pbm*; the black bean contains the pigment and the modification to purple, *PBm*; and the white bean contains both the modifier and the mottled color-pattern but no pigment, *pBM*. It is only because of the lack of pigment that these two characters possessed by the white bean are not apparent. *They are latent only in the sense that they are invisible.* Whenever the 'White flageolet' is crossed with any variety of self-colored bean, the three dominant allelomorphs, *PBM*, are brought together with the result seen in these hybrids, namely, a first generation characterized by dark purple mottled seeds.

[10] Tschermak, E., *loc. cit.*

[11] Bateson, W., Saunders, Miss E. R., Punnett, R. C., 'Experimental Studies in the Physiology of Heredity,' Second Report to the Evolution Committee of the Royal Society, London, 1905.

The great advantage of this explanation over that of Tschermak is that it brings these apparently aberrant results into harmony with typical Mendelian cases, and allows with a reasonable degree of accuracy, a prediction as to the composition of subsequent generations.

On the assumption that the F_1 hybrids between the 'White flageolet' and either of the non-purple self-colored beans contain the three dominant allelomorphs, *PBM*, associated with the corresponding recessive allelomorphs, *pbm*, the following forms and proportions may be expected in the second generation. In each 64 plants belonging to the second generation there should be

27 *PBM* = purple mottled like F_1.
9 *PbM* = brown mottled or yellow mottled.
9 *PBm* = purple self-colored or black.
9 *pBM* = white, exactly like the white parent.
3 *Pbm* = brown or yellow self-colored.
3 *pBm* = white (with the modifier but no mottling).
3 *pbM* = white (without the modifier but with mottling).
1 *pbm* = white (with neither modifier nor mottling).

Owing to the fact that the internal composition of the white beans has no external manifestation, the four white classes having different allelomorphic composition are indistinguishable from one another, thus resulting in a frequently found ratio for tripoly-hybrids, 27:9:9:3:16.

In this interpretation of latent characters are to be found explanations of several observed phenomena. Tschermak, Bateson and Emerson have noted that the behavior of a given character in one strain can not be used safely as a criterion for predicting the behavior of an apparently like character in another strain. A good illustration of this is seen on comparing with these hybrids of the 'White flageolet' bean, Emerson's cross between the 'Ultra' and 'Marrowfat,' the latter being likewise a white bean. The F_1 hybrids were brown mottled, thus showing that the 'Marrowfat' differs from the 'Navy' or 'White flageolet' in having no dominant pigment-changing allelomorph. The gametic formula of the 'Marrowfat' is, no doubt, *pbM*, and

in the table above, representing the F_2 of the cross between 'Ne plus ultra' and 'White flageolet' it is seen that one of the white derivatives from this cross has the same gametic composition as the 'Marrowfat.'

Emerson attempted no explanation of the different behavior of these beans, simply presenting them as exceptions to Mendel's laws or as evidences of the limitation of the usefulness of those laws in predicting the results of hybridization. Practically all of the exceptional results obtained by him cease to be exceptional when we cease to look upon the products of his crosses as monohybrids with respect to seed color. His second generation hybrids were classifiable into four categories instead of the three he expected, but his expectation was based upon the assumption that the black, brown, white, etc., are unit characters, and that the mottled hybrids were simply mosaics or blends between the white and the self-colored parents. The simple assumption, demonstrated in my hybrids, that the pigmentation and the mottling are distinct unit characters, harmonizes his results perfectly, though the numbers with which he dealt were too small for the satisfactory determination of the agreement or disagreement with the theoretical ratios of a dihybrid.

In discussing the appearance of purple spotting as a novelty in peas, Lock[12] follows Tschermak in referring the latent character to the pigmented parent, saying that "On crossing $A(B)$ (B being latent) with ab we get: F_1 $ABab$ (B latent having become B active)." If instead he had considered that Ab is crossed with aB, the A producing the pigment and the B aggregating it into spots, he would get the same F_1, namely $ABab$, but would have avoided the difficulty of a capricious unit which may be active or inactive under conditions that can not be determined. He would then have had no latent character in any other sense than that it was invisible owing to the absence of pigment.

The explanation here offered is essentially that presented by Cuénot for mouse hybrids, in which one unit is assumed to give pigmentation and another to determine the color which this pigment will exhibit. Cuénot considers the various colors to be latent in the albino and he is supported in this respect by my hybrids, but I prefer not to call this character a *latent pigment* but an *active pigment-changer*.

This reference of various colors to the action of a pigment-changer requires that the pigments upon which the various colors depend shall bear some simple relation to each other. I have made some preliminary studies on the pigments of these beans and have partially demonstrated this simple relation by converting the yellow and brown pigments to black by the use of alkalies but I have not yet been able to reverse the process. It is easily demonstrable that the black (dark purple) bean contains anthocyan, and this gives a simple explanation of the correlation between black seed-coats and red flowers, observed by Mendel and all other students who have chanced to use black-seeded peas or beans.

That the yellow, red, and black pigments of animals are closely related is also well known, and there can be no doubt that the 'latent black' which Castle[13] reported in certain albino guinea-pigs is to be interpreted exactly as Cuénot's mice, the black being due to the presence of a melanizer which is a unit character wholly independent of the pigment-producing unit. The fact that half the gametes of this individual carried the so-called 'latent black' simply showed the animal to be heterozygous with respect to this allelomorph, and the extracted recessives which did not in subsequent generations produce any black offspring could not do so for the simple reason that the pigment-changing unit had acted in a perfectly normal way and had been absolutely separated out into the black offspring while its recessive counterpart was segregated with equal purity into the non-black.

A very important consideration in this connection is the frequency with which the new character is atavistic. This shows the process

[12] Lock, R. H., 'Studies in Plant Breeding in the Tropics,' *Ann. Roy. Bot. Gard. Perideniya*, **2**: 299–356. See p. 341.

[13] Castle, W. E., *loc. cit.*

by which these various color varieties were originally produced. The original character was compound and the new variety was produced by the loss of one or more of the components. In other words these varieties are retrogressive. Beginning, for instance, with a purple mottled bean, one variety was formed by the loss of the mottling, another by the loss of the pigment, and another by the loss of the pigment-changer. Then by hybridization every possible combination of these three characters became the constant characteristics of distinct strains. When these varieties are crossed together the original variety may be reproduced by bringing together the several component parts of the original compound character.

There are still many mysteries regarding latent characters or qualities, but I believe the considerations here presented bring a large number of otherwise anomalous phenomena into perfect harmony with typical Mendelian cases of alternative inheritance. It appears to me certain that this conception of latent characters as *invisible* ones, which has already been used by Correns[14] to interpret in part the behavior of Mirabilis hybrids, can be extended to clear up his remaining difficulties, and that Bateson will find in the same conception an explanation of the complex behavior of his sweet peas and stocks without resort to the inexplicable synthesis and resolution of supposed hypallelomorphs.

George Harrison Shull
Station for Experimental Evolution,
Cold Spring Harbor, Long Island,
December, 1905

[14] Correns, C., 'Zur Kenntniss der scheinbar neuen Merkmale der Bastarde. Zweite Mittheilung über Bastardirungsversuche mit Mirabilis Sippen,' *Ber. d. d. Bot. Ges.*, **23**: 70–85, 1905.

QUOTATIONS

THE UNIVERSITY OF OXFORD

This appeal is now made on behalf of Oxford by the Chancellor and Vice-Chancellor of that University, and it is to be enforced at a public meeting of all persons interested in the subject to be held in London on Thursday, May 16, with the Chancellor of the University in the chair, supported by many men of light and leading from among those whom the University has already trained for the high station they adorn in Church and State. The appeal, however, is not made to old Oxford men alone; it is addressed to "all who are interested in the continued wellbeing and usefulness of the oldest University in the Empire." Nor is it in its present form and purpose an appeal for the complete equipment of the University with all the appliances, institutions, and endowments which would enable Oxford to hold her own in the coming time among the leaders in all departments of letters, learning, science, and the arts. That is an ideal which would require millions for its effective and practical realization. Cambridge has already asked for something like a million and a half and could probably find plenty of use for as much again. American Universities are almost daily being endowed on this hitherto unprecedented but by no means extravagant scale. Oxford is, for the present, less ambitious and perhaps more practical. She recognizes that even for Universities it is true that *non omnia possumus omnes.* The days are gone by, perhaps, when any University, even a multi-millionaire University, can profitably do as Bacon did when he aspired to take all knowledge for his province. Hence such new endowments as Oxford now hopes to obtain—£250,000 is all that is asked for at present, merely a paltry million dollars as American founders and benefactors might regard it—are to be directed into certain definite channels. Largely at the instance of Mr. T. A. Brassey, who has already set a goodly example by his active exertions and personal munificence, a scheme has been prepared which had received the hearty approval of the late Chancellor, Lord Goschen, before his death, and is supported by many high academical authorities and by a number of old Oxford men of the highest capacity and experience in many walks of life. An outline of this scheme will be found in the letter of the Chancellor and Vice-Chancellor. It includes provision for the promotion of modern studies, literary and scientific, such as modern languages, electrical research, the scientific basis of the training of

practical engineers, the study of hygiene and of scientific agriculture, and, last but not least, for the adequate equipment and endowment of that greatest of Oxford's academical institutions, the ancient and world-renowned library of Thomas Bodley's foundation.—*The London Times.*

CURRENT NOTES ON LAND FORMS

NARROW COASTAL PLAINS

WELL-DEFINED land forms have an importance in systematic physiography that is not yet fully enough recognized by travellers. Hence all the more satisfaction is felt when an article gives so definite an account of such a feature as a narrow coastal plain that it can be easily appreciated by the reader. Such is the case in the 'Notes on the Raised Beaches of Taltal (Northern Chile),' by O. H. Evans (*Quart. Journ. Geol. Soc.*, LXIII., 1907, 64–68).

The coastal plain at Taltal has a gently inclined surface, fringing the coastal ranges and extending up the broader valleys to a considerable altitude and distance from the present shore. There is local variation in the width of the plain, and in the altitude of its inner border (200 feet, back of Taltal) along the base of the mountains. The surface of the plain is thinly covered with angular fragments from the hills; but where sections reveal its structure, it is seen to consist of stratified sand and gravel, containing recent shells which are sometimes plentiful enough to form distinct beds. Here and there the subjacent rocks rise through the plain in curiously weathered remnants of former islets and stacks. Evidence of intermittent uplift is found in several terraces, three of which are relatively well defined at altitudes of about 15, 80 and 200 feet above sea-level; two more obscure terraces are seen at intermediate heights. Where the mountains approach the sea and the plain narrows, the terraces are replaced by lines of boulders; at other points a rock shelf and again a series of shallow caverns marks the former shore line. Sudden uplifts are inferred from the well-preserved condition of the shells. Although no explicit statement is made as to the relation of the larger inland valleys to the plain, it may be inferred from certain phrases that the valley floors are now well opened somewhat below the plain surface. Regarding the smaller ravines of the old-land hills, it is said that their beds "suddenly alter in inclination and become precipitous as they approach the sea. Were streams suddenly to start running in these old gorges, they would terminate in waterfalls." Whether this sudden steepening is at the former or at the present shore line, does not clearly appear.

Another narrow coastal plain is described by W. D. Smith as forming an interrupted rim around the mountainous island of Cebu, and containing nine tenths of its large population ('Contributions to the Physiography of the Philippine Islands: I., Cebu Island,' *Philippine Journ. Sci.*, I., 1906, 1043–1059). The basis of the plain is of coral rock, over which alluvial deposits have been spread by the streams and rivers from the interior valleys.

Brief description of what appears to be a small and undissected coastal plain on which Sidon is situated on the Mediterranean border of Palestine, is given by Libbey and Hoskins in their account of a journey to 'The Jordan valley and Petra' (2 vols., New York, Putnams, 1905). Its low and well-watered surface has a 'carpet of green' in strong contrast to the gray foot-hills which rise from its inner border. A similar coastal or littoral plain extends southward from the hills by Beirut (see p. 66, frontispiece, and plate on p. 41). I. B. AND W. M. D.

GLACIAL TROUGHS AND HANGING LATERAL VALLEYS

IN view of the ever-increasing volume of evidence to the effect that every glaciated mountain range in the world thus far studied shows a systematic association of peculiar features, such as valley-head cirques often holding rock-basin tarns, over-deepened main-valley troughs with floors of a considerable width, hanging lateral valleys, and Piedmont morainic amphitheaters, it is interesting to scrutinize the statements of certain geologists who still maintain that glaciers are ineffect-

ive eroding agents. Among these is W. Kilian, of Grenoble, whose studies have made him intimately familiar with many valleys of the French Alps, which most physiographers would regard as overdeepened by intense glacial erosion, but which Kilian explains otherwise ('L'érosion glaciare et la formation des terrasses,' *La Géogr.*, XIV., 1906, 261–274). These trough-like or broad U-shaped valleys, sharply incised beneath the gentler upper slopes ('paliers') which steepen somewhat in ascending to the peaks, he regards as the result of retrogressive torrential erosion during a late interglacial epoch, with slight modification by ice action during the last glacial epoch; the torrential action thus appealed to being itself explained as the result of an assumed change in the attitude of the land-mass with respect to base-level, and the hanging lateral valleys being accounted for as a result of the preponderance of erosion by the main stream.

It would certainly seem appropriate that those who adopt this hypothesis should, in the interests of thorough investigation, themselves be the first to give it an impartial test by looking to see if it applies in non-glaciated regions, where independent and acceptable evidence of change of base-level may be found, and where the disputed element of glacial erosion is ruled out of the case. Curiously enough, Kilian does not do this; nor does Heim, nor Garwood, nor Fairchild, who all, like Kilian, deny the efficiency of glacial erosion. It is true that reference is made by Kilian to recent articles by J. Brunhes, of Fribourg ('Sur les contradictions de l'érosion glaciare' and 'Sur une explication nouvelle de l'érosion glaciare,' *C. R. Acad. Sci.*, Paris, CXLII., 1906, 1234–1235; 1299–1301), to show that U-shaped valleys occur in non-glaciated districts; but Brunhes's articles are brief and general, and give little aid in solving the problem at issue.

Kilian himself states that U-shaped valleys may be produced by stream erosion in certain structures, and on this simple point there need be no dissent; but the peculiarity of glaciated valleys is that the U-shape prevails in all sorts of structures; thus indicating that glaciation and not structure is the determining factor. The Allegheny plateau, south of the glaciated area in the eastern United States, contains a good number of open U-shaped valleys, especially where relatively weak underlying strata are capped by stronger overlying strata; but all such open main valleys receive their lateral valleys at accordant grade, and thus differ most significantly from glaciated U-shaped valleys. It is singular that the non-glacialists do not themselves discover and accept this suggestive fact. As to the working hypothesis that retrogressive torrential erosion, excited by favorable change of base-level, may in time produce great trough-like valleys, certainly no one should, on *a priori* grounds, object to its due consideration; but this hypothesis normally requires the development of lateral valleys accordant with their main valley by the time that the main valley has gained an open floor; and as soon as the inquirer sees that the open Alpine troughs are constantly associated with discordant or hanging lateral valleys, it would seem to be incumbent upon him to set the working hypothesis aside as invalidated, and to look for another of greater competence.

Kilian and Brunhes both emphasize the importance of subglacial torrents, as Frech has done even more strongly ('Ueber das Antlitz der Tiroler Zentralalpen,' *Zft. Deut.-Oesterr. Alpenver.*, XXXIV., 1903, 1–31; see especially p. 22), in causing whatever erosion may have taken place during the glacial occupation of a valley; and it is to be presumed that no one would wish to minimize whatever aid may thus be given in a difficult problem; but it is inconsistent with all that is known of torrential action to think that, even under the constraint of subglacial flow, torrents can have accomplished the major part of the work that must be attributed to the general process of glacial erosion. Sharp-cleft gorges, such as that of the Aar in the rock-sill above Meiringen, and of various other Swiss rivers, may well be ascribed in large part to subglacial torrents; but the trough-like cross-section of a glaciated valley is not in the least what would be reasonably expected from the work of a high-pressure torrent. Indeed, the fact that

the lip of many hanging valleys is so little trenched is strongly suggestive of the relative inefficiency of sub-glacial torrents; for precisely in such positions of sharply increased descent should the torrents have been most effective.

W. M. D.

HANGING VALLEYS IN ENGLISH LAKELAND

AMONG the recent essays which explain hanging lateral valleys otherwise than by glacial overdeepening of the main valley is one by J. E. Marr, of Cambridge, England, on 'The Influence of the Geological Structure of English Lakeland upon its Present Features' (presidential address, *Quart. Journ. Geol. Soc.*, London, LXII., 1906, lxvi–cxxviii; see p. cvii–). The greater depth of the open main valleys is here ascribed to normal erosion on weak structural features called 'shatter belts'; but under this explanation—glacial erosion being disregarded—it is difficult to understand why the lateral streams, which often mouth from 500 to 1,000 feet over an open main valley floor, have accomplished so little trenching of their hanging valleys during the long period in which the main valleys were well widened by the slow processes of general subaerial erosion. There are many cases in non-glaciated districts where wide longitudinal valleys on belts of weak rocks are joined by narrow lateral valleys whose small streams enter the main valley through belts of hard rocks; the Allegheny Mountains present hundreds of examples of this kind: but in practically all such cases, even when the contrast in resistance of the hard and weak rocks is strongly pronounced, the small lateral stream has been able to cut its narrow notch in the hard rocks down to accordant grade with the main valley floor that has been opened on the weaker rocks; for the widening of the main valley by general subaerial erosion has been a relatively long process even in its weak rocks. The streams in the hanging valleys of English Lakeland would then be exceptions to this rule, if their hanging position is not to be explained by the glacial overdeepening of the main valleys. A number of cases of stream capture and rearrangement are described by Marr in this connection; but as glacial erosion is entirely omitted from the problem, the explanation by normal stream action alone must remain in the same measure of doubt as that which now obscures the explanation of the rearrangement of various branches of the Rhine in the neighborhood of Chur, Switzerland, by normal stream action, as stated a score of years ago by Heim. W. M. D.

HANGING VALLEYS IN GENERAL

SINCE the convincing report on the glaciers of Alaska by Gilbert (Harriman Alaska Expedition, III., 1904), additional accounts of main-valley troughs and hanging lateral valleys, regarded as the result of glacial erosion, are given for the mountains of Alaska by R. S. Tarr ('Glacial Erosion in Alaska,' *Pop. Sci. Monthly*, LXX., 1907, 99–119), and by R. S. Tarr and L. Martin ('Glaciers and Glaciation of Yakutat Bay, Alaska,' *Bull. Amer. Geogr. Soc.*, XXXVIII., 1906, 145–167; see p. 159, figs. 17 and 18); for Norway by A. P. Brigham ('The Fiords of Norway,' *ibid.*, XXXVIII., 1906[1]); for the Tian Shan mountains by Friederichsen (see these 'Notes,' March 8, 1907); for the New Zealand Alps by E. C. Andrews ('Some interesting facts concerning the glaciation of southwestern New Zealand,' *Trans. Austral. Assoc. Adv. Sci.*, 1905, 189–205; good plates); for the Sierra Nevada by A. C. Lawson ('The Geomorphogeny of the Upper Kern Basin,' Bull. Dept. Geol., Univ. Calif., III., 1904, 291–376; see p. 329); and for the Sawatch range of the Colorado Rocky Mountains by L. G. Westgate ('The Twin Lakes Glaciated Area,' *Journ. Geol.*, XIII., 1905, 285–312) and by the undersigned ('Glaciation of the Sawatch Range, Colorado,' *Bull. Mus. Comp. Zool., Harv. Coll.*, XLIX., 1905, 1–11).

[1] The pages of this article are not cited here, because the reprint from which this reference is made has been repaged, and consequently affords no sufficient indication of its original place. If editors of scientific periodicals still persist in the troublesome habit of repaging reprints, it is to be hoped that authors and reviewers will protest against it.

Fig. 1.—A normally eroded mountain mass, not affected by glacial erosion.

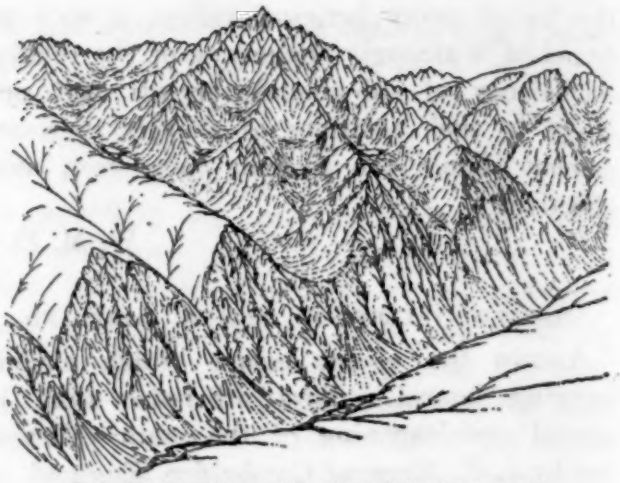

Fig. 3.—The same mountain mass as in Fig. 2, shortly after the glaciers have melted from its valleys.

The three diagrams here presented are reproduced from an article by the undersigned on 'The sculpture of mountains by glaciers' (*Scot. Geogr. Mag.*, XXII., 1906, 76–89), in which evidence for glacial erosion is found in a comparison of glaciated and non-glaciated mountains, entirely independent of whether glaciers are known to be capable of eroding or not. In view of the inaccessibility of the

Fig. 2.—The same mountain mass as in Fig. 1, strongly affected by glaciers which still occupy its valleys.

bottom of a large Alpine glacier, it is believed that the best means of determining whether it acts as a sculpturing agent or not is to be found in a comparison of districts, otherwise similar, one of which has not been glaciated, while the other has been glaciated. The diagrams are not drawn from nature, although they summarize a variety of facts seen in various mountain ranges. The third one of the series may be taken as typical of La Plata peak, in the Sawatch range of Colorado, and of the overdeepened trough of Lake Creek beneath it, with a well-defined hanging lateral valley between the two.

It is of interest to note in this connection that a good explanation of hanging lateral valleys was given earlier than the date, 1898, usually assigned for this important advance in rational physiography; namely, in 1888, by La Noé and Margerie, in *'Les formes du terrain'* (Paris, *Service géograph. de l'armée*, p. 177), where the cause of the discordance of hanging lateral valleys over their trough-like main valleys is very clearly set forth.

W. M. D.

THE WISTAR INSTITUTE OF ANATOMY

The annual meeting of the advisory board of anatomists of the Wistar Institute was held on April 14 to 16. The members of the board present were Professors Barker, Donaldson, Gage, Huber, Huntington, Mall, McMurrich, Minot and Piersol; of the institute's staff, Drs. Greenman, Hatai, Stotsenburg and Streeter; of the institute's board of managers, Drs. Brown and Lewis.

The board held two sessions on Monday, April 15.

The general work of the year and the financial condition of the institute were explained by M. J. Greenman, the director.

The research in neurology was reviewed by Professor Henry H. Donaldson, chief of the neurological research of the institute. Professor Donaldson also reported upon the Vienna meeting of the International Brain Commission (May, 1906) and stated that an

important result of this commission would be the organization of special institutes for the study of the central nervous system and the establishment of international relations for the advancement of this study.

From Professor Donaldson's statement of the research work it appears that the investigations now under way at the institute are as follows:

The development of the fiber tracts in the brain of the human embryo, together with some experimental work for the control of these observations (Streeter); biometric studies on the skull and nervous system of the albino rat as modified by age and nutrition, and the chemistry of nerve tissue (Hatai); the growth of the white rat before birth (Stotsenburg); the development of the heart and vessels of teleosts (Senior); regeneration of the peripheral nerves (Greenman); and a comparison of the growth of the nervous system and its parts in the albino rat and man (Donaldson).

The committee on further organization of the neurological workers of the country consisting of Donaldson, Piersol and LeConte reported progress.

Professor Gage, chairman of the committee on relations of the Wistar Institute to American anatomists, reported that they had issued a circular letter to the anatomists of the country, and that this had served the desired purpose of bringing the anatomists and the Wistar Institute into closer relations. The committee is to remain as a permanent one for further work of this kind.

As a central institute for brain research, the institute is desirous of securing for distribution exact information concerning the facilities for neurological work in this country. It was proposed to obtain this by means of both a circular letter and special inspection of laboratories, but the matter was left with the institute staff for final action.

Dr. Huntington, chairman of the committee on comparative anatomy and embryology, spoke encouragingly of the outlook for the future, and suggested that material for comparative anatomy be collected, with especial reference to the general subject of vascular morphology. Dr. Piersol urged in this connection the collection of human embryos.

The following general suggestions were made:

By Professor Barker, that the question of library be considered at an early date, and that the institute prepare a statement concerning the collections of anatomical literature in the city; secure the more important periodicals, and be prepared to purchase essential books of reference and new monographs, taking care not to duplicate books or journals, except where these were constantly needed in the building.

Professor Gage made the suggestion that the institute organize a bureau for information, bearing on the acquisition of materials, apparatus, models, photographs, etc., useful to anatomists. In this the institute would have the assistance of the board and others interested, and the work would be thus facilitated. The suggestion was recorded and will be carried out. Any assistance which anatomists or zoologists can render the institute in executing this plan will be gratefully received.

The publication of monographs was suggested by Professors Huber and Mall. It was the general opinion of the board that desirable monographs might be accepted by the board, published in the *American Journal of Anatomy* at the institute's expense, and as the edition was sold, the institute could then be reimbursed. This suggestion was so recorded, and will be carefully considered with reference to future action.

Professor Minot proposed that the institute take charge of the reproduction of original models and lantern slides. He stated that there were many original drawings which authors would entrust to the institute for the purpose of having lantern slides made from them, when they would not loan them to dealers. The reproduction of original models, as well as lantern slides, was favored by the board, and it was unanimously agreed that this was a most desirable undertaking. The suggestion did not imply that the institute should in any way act in a commercial capacity, but merely publish or reproduce models and lantern slides which can not be otherwise

obtained. The cooperation of the members of the board was promised for this work, and it is expected that the institute will take it up soon.

BERMUDA BIOLOGICAL EXPEDITION

By an arrangement with the Bermuda Natural History Society, apportunity is offered for a limited number of instructors and research students in zoology and botany to spend a few weeks at the Bermuda Biological Station this summer.

Members of the expedition will sail from New York on the steamer Bermudian (Quebec Steamship Co.) at 11 A.M. on Wednesday, June 19, arriving in Bermuda June 21, and returning will sail on August 7. Those who can not sail on June 19, may do so two weeks later—July 3.

The expense will be $107 for first-class passage from New York to Bermuda and return, and for board and lodging at the Islands six weeks and five days. For the shorter time —four weeks and five days in Bermuda—the expense will be $90. Payments are to be made to the undersigned,—fifty dollars twenty days before sailing, the balance on arriving in Bermuda.

For further information apply to

E. L. Mark

109 Irving Street,
Cambridge, Mass.

MINUTES OF THE FIRST MEETING OF THE COMMITTEE ON SEISMOLOGY

The initial meeting of the committee on seismology of the American Association for the Advancement of Science, was called to order in the council room of the Cosmos Club, Washington, D. C., at 10 o'clock on April 19, 1907. There were present L. A. Bauer, W. W. Campbell, J. F. Hayford, W. H. Hobbs, A. C. Lawson, C. F. Marvin, W J McGee and H. F. Reid. The members of the committee unable to attend the meeting were C. E. Dutton, G. K. Gilbert, L. M. Hoskins, T. A. Jaggar, Otto Klotz, C. J. Rockwood, Jr., and R. S. Tarr.

Mr. H. F. Reid was made temporary chairman, and in the deliberations of the committee which continued throughout the day, the counsel was sought of the heads of the principal government and other bureaus likely to be instrumental in furthering the objects before the committee. O. H. Tittmann, superintendent of the U. S. Coast and Geodetic Survey; G. O. Smith, director of the U. S. Geological Survey; C. D. Walcott, secretary of the Smithsonian Institution, and R. S. Woodward, president of the Carnegie Institution of Washington, were all for a portion of the time in attendance upon the meeting and expressed their approval of the plans and purposes of the committee. Willis L. Moore, chief of the U. S. Weather Bureau, whose counsel was sought, could not be reached.[1] The following resolutions were adopted by the committee: (1) In the judgment of the committee its functions should be regarded as initiatory and advisory. (2) In the judgment of the committee the time has come for asking the support of the federal government in seismological work. (3) This seismological work requires a cooperation of the various scientific bureaus of the government. (4) The appropriations for seismological stations should be made through the U. S. Weather Bureau, and the results of the observations should appear in its publications. (5) A subcommittee of three, to include the chairman of the committee, should confer with the chief of the Weather Bureau, the superintendent of the Coast and Geodetic Survey, and the director of the Geological Survey with reference to framing the legislation providing for seismological stations and the publication of observations, as recommended in the preceding resolution.

A permanent organization of the committee was effected by the election of H. F. Reid, chairman, and William H. Hobbs, secretary.

The following subcommittees were named: (1) A committee to determine the best form or forms of seismograph for the seismological stations to be established—Messrs. Reid, Marvin and Bauer. (2) A committee of three members with power to add to its number, to report as to what action is deemed desirable

[1] Chief Moore later expressed his hearty approval of the committee's plans.

in reference to recommendations concerning earthquake-proof construction—Messrs. Lawson, McGee and Campbell. (3) A committee for carrying out resolution 5—Messrs. Reid, Marvin and Hayford.

The committee then adjourned to reassemble during the meeting of the American Association in December next, when the association will be asked to make a grant for defraying the necessary expenses of the committee.

WILLIAM H. HOBBS,
Secretary

SCIENTIFIC NOTES AND NEWS

SIR WILLIAM RAMSAY has been elected an honorary member of the Academy of Sciences of Christiania.

THE degree of doctor of science will be conferred by Cambridge University on Sir Clements Robert Markham, Colonel Sir Thomas Hungerford Holdich and Sir Thomas Richard Fraser, professor of materia medica and of clinical medicine in the University of Edinburgh.

THE Royal Institution has awarded the Actonian prize of one hundred guineas to Madame Curie.

M. HENRI POINCARÉ, professor of mathematical astronomy at the University of Paris, has been appointed a member of the Council of the Teaching of Fine Arts in the room of the late M. Berthelot.

DR. FRANK BILLINGS, dean of the Rush Medical College, University of Chicago, has been elected president of the National Association for the Study and Prevention of Tuberculosis.

DR. GEORGE A. PIERSOL, professor of anatomy at the University of Pennsylvania, was on May 2 elected president of the Pennsylvania chapter of the Society of Sigma Xi.

AT the annual banquet of the Alumni Association of the Philadelphia College of Pharmacy, held on May 14, there was presented to the college an oil portrait of Professor Joseph P. Remington, given in honor of his thirty-fifth anniversary as member of the faculty.

DR. L. R. ABRAMS, of Stanford University, has been granted a leave of absence to enable him to review the manuscripts of a series of volumes in course of preparation by the Cree Publishing Company, giving a popular account of the plant-breeding work of Mr. Luther Burbank. Dr. Abrams moved to Santa Rosa, Cal., and assumed his new duties on May 1.

DR. EDWARD CAIRD, the master of Balliol College, Oxford, has been compelled by ill health to resign the mastership, to which he was elected in 1893, in succession to Professor Jowett, having been formerly fellow of Merton College and professor of moral philosophy in the University of Glasgow.

CHARLES C. ADAMS, of the University of Cincinnati, has resigned the directorship of the museum of the Cincinnati Society of Natural History.

PLANS have recently been perfected for a detailed and systematic investigation of the Atlantic and Gulf Coastal Plain stratigraphy and paleontology, several State Surveys, including North Carolina, Georgia, Alabama and Mississippi acting in cooperation with the United States Geological Survey in the studies. The aim of the work is to determine the extent of the subdivisions recognized in New Jersey and Maryland on the north and Alabama on the south, to determine their relations to one another, and in general to establish satisfactory correlations throughout the district between the Potomac and the Mississippi River. Economic studies, especially on the phosphates, will also be made incidentally. The general supervision of the work rests with a board of supervising geologists, consisting of the state geologists in the Coastal Plain districts and the chief geologist and chief hydrographer of the national survey, Dr. W. B. Clark being chairman. The field work is in charge of Mr. M. L. Fuller, who will put seven parties into the field the coming summer. It is hoped to complete the investigation in Virginia, North Carolina, South Carolina and Florida during the next year, while the work in the remaining states will be finished in 1908 and 1909.

THE medical corps of the navy has not been able to get enough surgeons to meet the needs

of the service. Admiral Rixey, the surgeon general, has undertaken to give temporary appointments as 'acting assistant surgeons' to the young men who will pass a satisfactory preliminary examination and come to Washington for instruction. They will receive six months' special training at the Naval Medical School and Hospital, or at the Mare Island Naval Hospital. At the end of that course they will receive appointments as assistant surgeons, with an annual salary of $1,760, supplemented by allowances of $432 and mileage. The shortage of doctors in the navy has become really serious. There are sixty-four vacancies in a corps that at its maximum should number only 350.

At its meeting of May 30, the Wisconsin Natural History Society will celebrate the fiftieth anniversary of its foundation. Mr. Charles H. Doerflinger will give a brief sketch of the founding of the society, and Professor E. A. Birge, of the University of Wisconsin, will speak on 'Science and the People.'

UNIVERSITY AND EDUCATIONAL NEWS

An alumnus of the College of the City of New York, who prefers to withhold his name has given $10,000 to the institution.

Columbia University has received a gift of $1,000 from Mr. Charles S. Bartow, towards a mathematical laboratory and museum, and $500 from an anonymous donor for researches in anthropology.

Dr. Benjamin Ide Wheeler, since 1899 president of the University of California and previously professor of Greek at Cornell University, has been offered the presidency of the Massachusetts Institute of Technology by the subcommittee of the corporation. The offer must be confirmed by the corporation, and it is not certain that President Wheeler will accept.

Dr. John Scholte Nollen, head of the German department at Indiana University, has been called to the presidency of the Lake Forest University, to succeed Dr. Richard Harlan, who resigned last autumn.

Frank P. McKibben, associate professor of civil engineering at the Massachusetts Institute of Technology, has been appointed professor of civil engineering at Lehigh University, in charge of the department, in place of Professor Mansfield Merriman, who has resigned after a record of twenty-eight years' service.

Dr. J. Bishop Tingle, who during the past three years has been assistant in charge of the Laboratory of Organic Chemistry in the Johns Hopkins University, and assistant editor of the *American Chemical Journal*, has been appointed professor of chemistry at McMaster University, Toronto, Canada.

Professor Frederic E. Clements, of the chair of plant physiology in the University of Nebraska has accepted a call to the professorship of botany in the University of Minnesota. He will sever his connection with the University of Nebraska, in which he has been a teacher for thirteen years, in time to enable him to assume the duties of his new position at the opening of the fall semester. He continues the present summer his studies of Rocky Mountain Botany at the Pike's Peak Laboratory near Manitou, and in addition is to make more extended studies in other parts of Colorado. As heretofore, he is to be accompanied by a party of advanced students.

Dr. G. F. Ruediger, until recently of the Memorial Institute for Infectious Diseases, Chicago, has been appointed professor of pathology and bacteriology in the University of North Dakota. The position includes the directorship of the state health laboratory.

Dr. Elias Potter Lyon was unanimously elected dean of the Medical Department of the St. Louis University at the May meeting of the board of directors. Dr. Lyon received his bachelor's degree at Hillsdale College in 1892; the doctorate in philosophy at the University of Chicago in 1897. He was instructor in biology at the Bradley Institute, Peoria, assistant professor of physiology at the Rush Medical College and finally dean of medical work at the Chicago University before taking charge of the Department of Physiology at the St. Louis University in 1904.